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LONG RANGE SEISMIC MEASUREMENTS

NASH

19 JANUARY 1967

Prepared for

AIR FORCE TECHNICAL APPLICATIONS CENTER

Washington, D. C.

2 JUNE 1967

By

TELEDYNE INC.

Under

Project VELA UNIFORM

Sponsored By

ADVANCED RESEARCH PROJECTS AGENCY

Nuclear Test Detection Office

ARPA Order No. 624

BEST
AVAILABLE COPY

LONG RANGE SEISMIC MEASUREMENTS

NASH

19 January 1967

SEISMIC DATA LABORATORY REPORT NO.184

AFTAC Project No.:	VELA T/6702
Project Title:	Seismic Data Laboratory
ARPA Order No.:	624
ARPA Program Code No.:	5810
Name of Contractor:	TELEDYNE, INC.
Contract No.:	F 33657-67-C-1313
Date of Contract:	3 March 1967
Amount of Contract:	$ 1,735,617
Contract Expiration Date:	2 March 1968
Project Manager:	William C. Dean (703) 836-7644

P. O. Box 334, Alexandria, Virginia

AVAILABILITY

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This research was supported by the Advanced Research Projects Agency, Nuclear Test Detection Office, under Project VELA-UNIFORM and accomplished under the technical direction of the Air Force Technical Applications Center under Contract F 33657-67-C-1313.

TABLE OF CONTENTS

NASH

EVENT DESCRIPTION

DATE:	19 January 1967
TIME OF ORIGIN:	16:45:00.1Z
YIELD:	
MAGNITUDE:	5.25 ± 0.50
LOCATION:	

SITE: Nevada Test Site, Area U2ce

GEOGRAPHIC COORDINATES:

Lat: 37°08'37.0" N

Long: 116°08'07.0" W

ENVIRONMENT:

GEOLOGIC MEDIUM:	TUFF
SURFACE ELEVATION:	4764 ft.
SHOT ELEVATION:	3564 ft.
SHOT DEPTH:	1200 ft.

COMPUTED EPICENTER: ALL STATIONS

GEOGRAPHIC COORDINATES:

Lat: 37°03'18.0" N

Long: 116°14'42.0" W

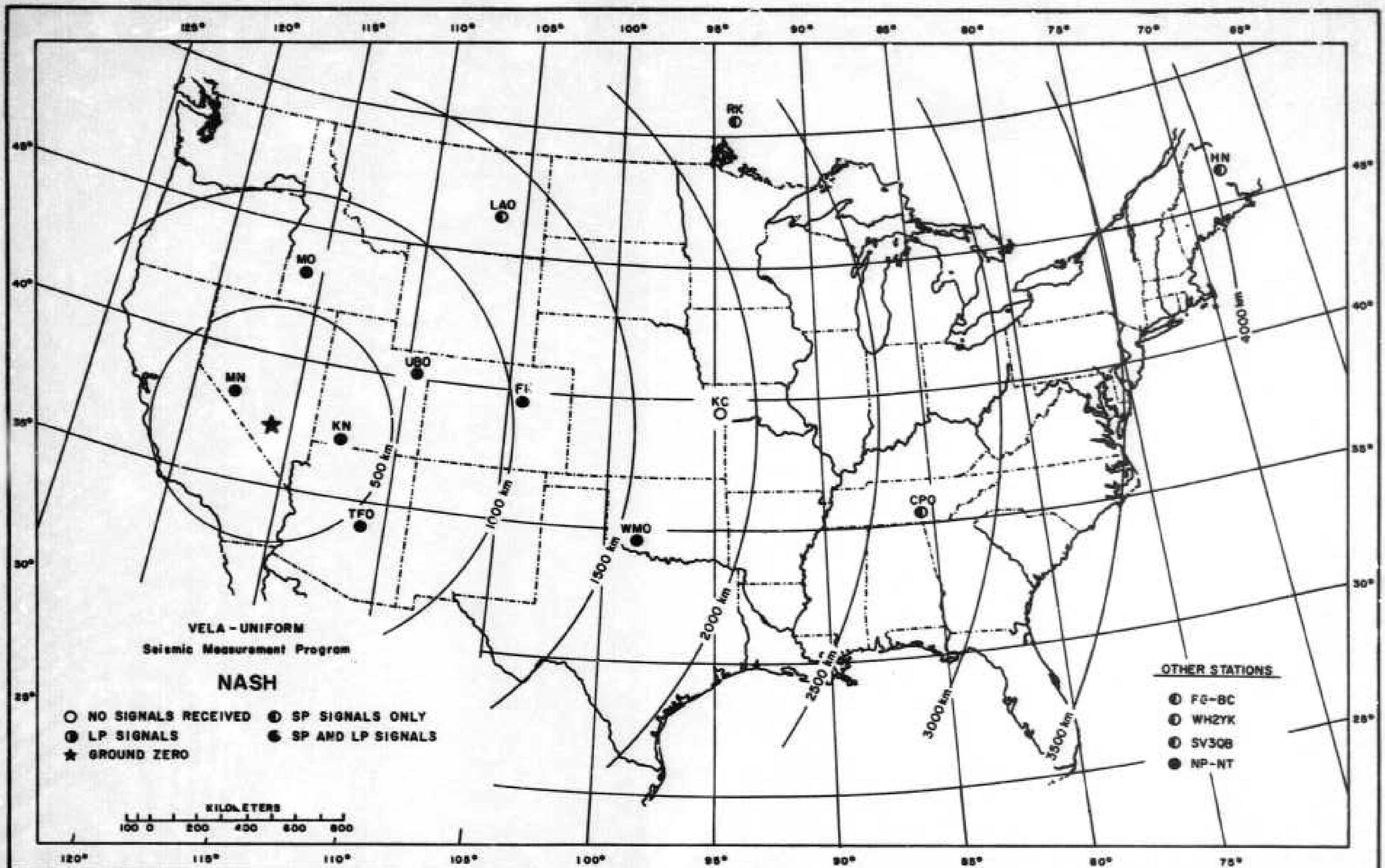
TIME OF ORIGIN:	16:45:00.6Z
DEPTH CONSTRAINED TO:	0 km
EPICENTER SHIFT:	13.9 km, S 45° W

					Final				
Code	Station	SPZ	SPR	SPT	LPZ	LPR	LPT	Tape	Timing
MN-NV	Mina, Nevada	+	+	+	+	+	+	*	P
KN-UT	Kanab, Utah	+	+	+	+	+	+	*	P
TFSO	Tonto Forest Observatory, Arizona	+	+	+	+	-	-	*	P
MO-ID	Mountain Home, Idaho	+	-	-	+	+	-	*	P
UBSO	Uinta Basin Observatory, Utah	+	+	+	+	-	-	*	P
FK-CO	Franktown, Colorado	+	+	+	+	+	+	*	P
LAO	Subarray AO-10, Montana	+	N	N	-	N	N		P
WMSO	Wichita Mountain Observatory, Oklahoma	+	+	+	+	+	+	*	P
KC-MO	Kansas City, Missouri	M	M	M	M	M	M		
PG-BC	Prince George, British Columbia, Canada	+	+	+	-	-	-	*	P
RK-ON	Red Lake, Ontario,Canada	+	+	+	-	-	-	*	P
CPSO	Cumberland Plateau Observatory, Tennessee	+	+	+	-	-	-	*	P
WH2YK	Whitehorse, Yukon Territory, Canada	+	+	+	-	-	-	*	P
HN-ME	Houlton, Maine	+	+	+	-	-	-	*	P
SV3QB	Schefferville, Quebec Canada	+	+	+	-	-	-	*	P
NP-NT	Mould Bay, Northwest Territories, Canada	+	+	+	+	+	-	*	P

M Moving
N No Instrument
P Primary Timing
* Magnetic Tape Available
+ Signal
- No Usable Signal

Station Status Report - NASH

TABLE 1



Recording Stations and Signals Received

Figure 1

INTRODUCTION

A long range seismic measurements (LRSM) program and several larger seismographic observatories were established under VELA-UNIFORM to record seismological data resulting from natural seismic activity and a planned series of U. S. underground nuclear tests. The LRSM teams are mobile and occupy locations selected to provide optimum data from events of special interest; the observatories are permanent installations as follows:

Wichita Mountains Seismological Observatory (WMSO)
Lawton, Oklahoma

Uinta Basin Seismological Observatory (UBSO)
Vernal, Utah

Cumberland Plateau Seismological Observatory (CPSO)
McMinnville, Tennessee

Tonto Forest Seismological Observatory (TFSO)
Payson, Arizona

Large Aperture Seismic Array (LASA)
Billings, Montana

The purpose of this report is to provide an analysis of data resulting from the NASH event recorded by the LRSM teams and the VELA observatories and a preliminary summary of data reported by other permanent and temporary seismographic stations.

INSTRUMENTATION AND PROCEDURE

The instrumentation at each of the LRSM locations consists of three-component short-period and three-component long-period seismographs. In general, data are recorded on 35 millimeter film

and on one-inch 14 channel magnetic tape, although recently more portable instrumentation has been incorporated which records only on magnetic tape. The stations are all equipped to record WWV continuously to provide accurate time control. Calibration is accomplished once each day and just prior to each shot at the operational settings. Pertinent information useful for analysis of LRSM data is available to qualified users of this data and is contained in Technical Report 65-43, "Interpretation and Usage of Seismic Data, LRSM Program." General information on LRSM van and portable system equipment and operation is given in Technical Report 66-27, "The LRSM Mobile Seismological Laboratory," and 65-74, "A Portable Seismograph." Copies of these reports may be obtained from DDC. The AD control number of Technical Report 66-27 is 480343. All the observatories have both long-period and short-period, three-component instrumentation, in addition to their other specialized facilities.

Station information is presented in Appendix I. This includes the station name and code; the geographic coordinates; the distances and azimuths involved; the station elevations; and the type of instruments in use at each location. Representative instrumental response curves are shown in Appendix II(B), II(C), and II(D).

The procedures used in measuring amplitudes reported herein is illustrated in Appendix II(A) and the unified magnitude is calculated as shown in Appendix I(B). The distance factors (B) beyond 16° are

from Gutenberg and Richter*. `or distance less than 16^{o} values were read from a curve in the Gutenberg and Richter paper back to 10^{o} and then extrapolated to 2^{o}, using an inverse cube relationship. An additional magnitude for less than 16^{o} was computed using a method described by Evernden**. (Figure 3).

A standard hypocenter location program for a digital computer is used to determine the location using data from all stations analyzed. Best-fit values of latitude, longitude, depth of focus, and time of origin are determined statistically by a least squares technique. This utilizes a Jeffreys-Bullen travel-time curve as modified by Herrin in 1961 on the basis of Pacific surface-focus recordings. Precision of the computation is limited primarily by the accuracy of arrival times, the validity of the standard travel-time curve, and by local velocity deviations. This method is based on P-wave arrivals with depth constrained to zero.

DATA AND RESULTS (LRSM AND VELA OBSERVATORIES)

The parameters of the NASH event and a summary of the seismic evaluation is shown on the Event Description page. The operational status of the 16 LRSM stations and observatories is given in Table I and illustrated in Figure 1.

*Gutenberg, B. and Richter, C. F., Magnitude and Energy of Earthquakes, Ann. Geofis., 9 (1956), pp. 1-15.

**Evernden, J. F., Magnitude Determination at Regional and Near Regional Distances in the United States, AFTAC/VEAL Seismological Center Technical Report VU-65-4A, (1965), pp. 6, 13.

Table 2 summarizes the measurements made of the principal phases from the NASH event at the LRSM and VELA stations. Included are the Pn and P arrival times, the maximum amplitudes (A/T) of Pn or P motion and other phases as seen on the short-period vertical instruments. Long-period Love and Rayleigh wave motion are also tabulated in (A/T) form. In addition, individual station Rayleigh wave areas (mm^2) is indicated as measured on the LPZ only. Although reduced to 1K magnification, they have not been normalized to any magnitude. Fifteen stations recorded short-period signals. Long-period signals from this event were recorded by eight stations.

The unified magnitudes determined from the LRSM and VELA observatories is shown in Figure 2. The average magnitude is 5.25 $\pm$ 0.50. The adjusted unified magnitude is 4.94 $\pm$ 0.55 and is shown in Figure 3.

The travel-time residuals from the Pn and P phases are shown in Figure 4. Figures 5 through 9 illustrate plots of the amplitude of P, Pg, Lg, LQ and LR.

Attached to the report are illustrated seismograms showing the signals recorded at four stations. The most distant station analyzed that recorded NASH was NP-NT at a distance 4363 kilometers.

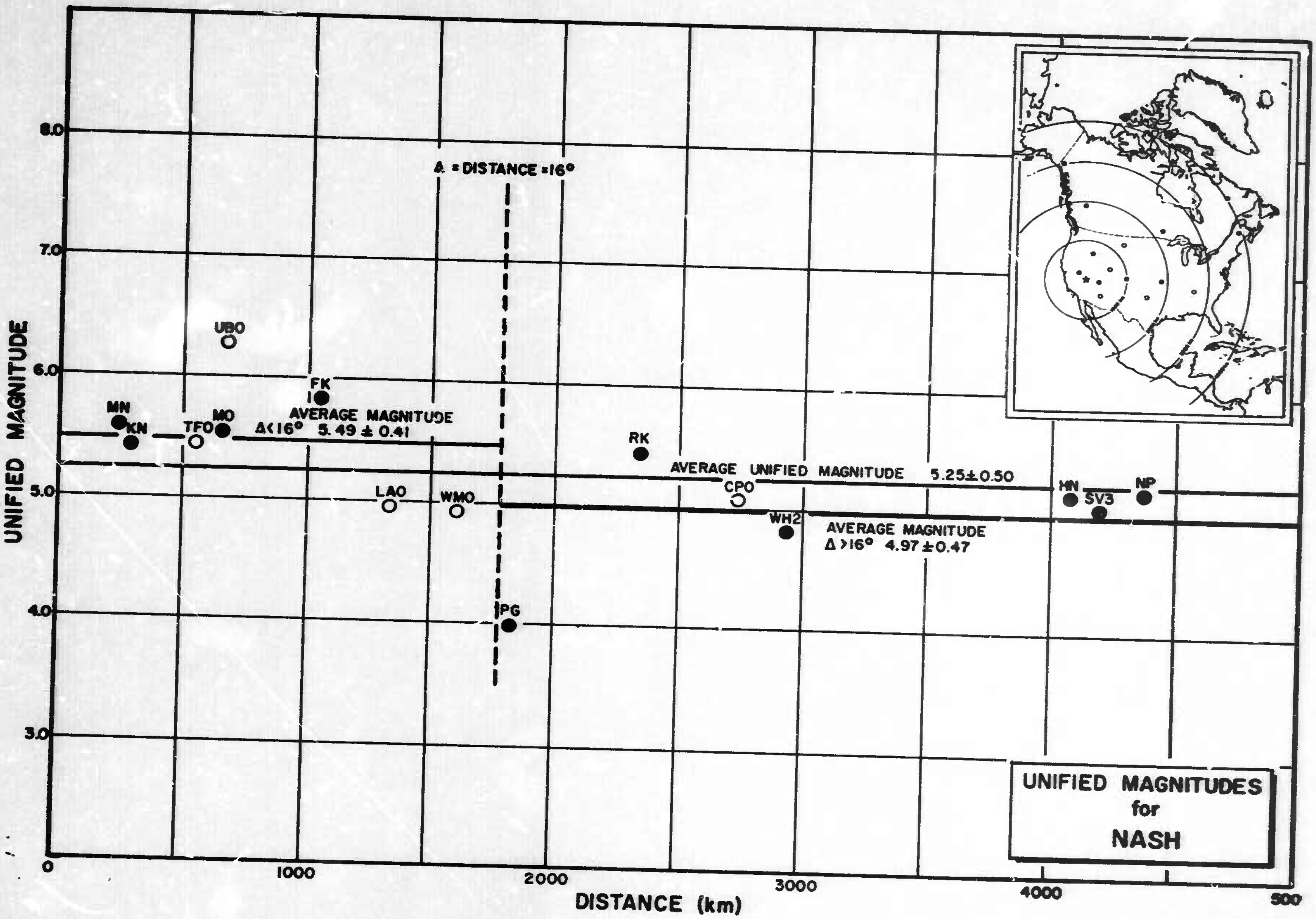
Principal Phases
NASH
19 January 1967
16:45:00.18

Code	Station	Distance (km)	Inst.	Magnification (k) Film x 10	Phase	Observed Travel Time (min)	Observed Travel Time (sec)	Period T (sec)	Maximum Amplitude A/T	Magnitude mb	Magnitude ms	Area (mm^2) LPS
MN-NV	Mina, Nevada	228	SPZ	4.86	Pn		35.5	0.4	2293	5.59	5.19	
			SPS	.896*	Pg		38.1	0.5	(8484)			
			SPT	2.22	Lg			0.7	10043			
			LPT	45.1	LQ			(10.0)	(169)			
			LPZ	4.3	LR			(13.0)	(777)			
KN-UT	Kanab, Utah	294	SPZ	10.3	Pn		44.1	0.4	796	5.42	5.05	141.28
			SPS	2.59*	Pg		48.9	0.6	6329			
			SPT	2.05*	Lg			0.8	6633			
			LPT	44.1	LQ			11.0	434			
			LPZ	5.55	LR			12.0	397			
TFSO	Tonto Forest Observatory, Arizona	543	SPZ-60	33.8	Pn	1	16.1	0.4	124	5.45	5.02	48.20
			SPZ-60	16.6*	Pg	1	30.9	0.8	492			
			SPN	16.6*	Lg			1.2	560			
			SPE	23.0*	Lg			1.2	465			
			LPN	38.5	LQ			10.0	(130)			
			LPE	37.0	LQ			10.0	(142)			
			LPZ	3.0	LR			15.0	799			
MO-IO	Mountain Home, Idaho	659	SPZ	15.8	Pn	1	31.0	0.4	(93.1)	(5.55)	(5.20)	147.72
			SPS		Pg	1	(48.9)	---	---			
			SPT		Lg			---	---			
			LPT		LQ			---	---			
			LPZ	7.6	LR			16.0	58.6			
UBSO	Uinta Basin Observatory Utah	671	SPZ-10	5.3	Pn	1	(33.9)	0.8	363	6.17	5.95	55.26
			SPZ-10	5.3	a	1	44.5	0.65	159			
			SPZ-10	5.3	Pg	1	52.3	0.9	1113			
			SPN	5.3	Lg			1.4	708			
			SPE	5.3	Lg			1.4	1281			
			LPE		LQ			x x x	x x x			
			LPZ	26	LR			(15.0)	(31.2)			
FK-CO	Franktown, Colorado	1055	SPZ	133*	Pn	2	(20.9)	0.8	38.7	5.04	4.36	29.81
			SPZ	133*	a	2	36.1	0.9	85.4			
			SPS	133*	Pg	2	55.5	0.8	149			
			SPT	142*	Lg			1.8	710			
			LPT	37.4	LQ			13.0	203			
			LPS	6.48	LR			10.0	385			
LAO	Subarray AO-10 Montana	1340	SPZ	325	Pn	2	(5[illegible])	(0.8)	(7.1)	(4.95)	(3.84)	30.09
			SPZ	325	a	2	[illegible]5.5	0.8	37.2			
			SPZ	37.5	(PP)	3	01.[illegible]	0.8	58.3			
			SPZ	37.5	(PPP)	3	08.2	0.9	80.3			
			SPZ	37.5	a	3	19.9	0.9	67.9			
			LPS	52.5	LR			x x x	x x x			
WMSO-Z	Wichita Mountain Observatory, Oklahoma	1[illegible]	SPZ	52.5	P	3	(27.8)	1.2	29.4	4.94	4.62	
			SPZ	52.5	o	3	37.[illegible]	1.2	24.1			
			SPZ	52.5	Pg	4	29.9	1.0	52.4			
			SPN	52.5	Lg			1.9	227			
			SPE	47.5	Lg			1.8	146			
			LPN	11.0	LQ			14.0	52			
			LPZ	12.3	LR			18.0	35.9			
PG-BC	Prince George, British Columbia, Canada	1938	SPZ	158	P	4	06.1	1.0	(11.9)	(3.98)		38.41
			SPZ	158	a	4	08.1	1.0	71.2			
			SPZ	158	a	4	11.2	0.9	63.9			
			SPZ	158	PP	4	22.1	1.0	48.3			
			SPS	149	Lg			(2.2)	(92.6)			
			SPT	169	Lg			(2.1)	(103)			
			LPT		LQ			x x x	x x x			
			LPZ		LR			x x x	x x x			

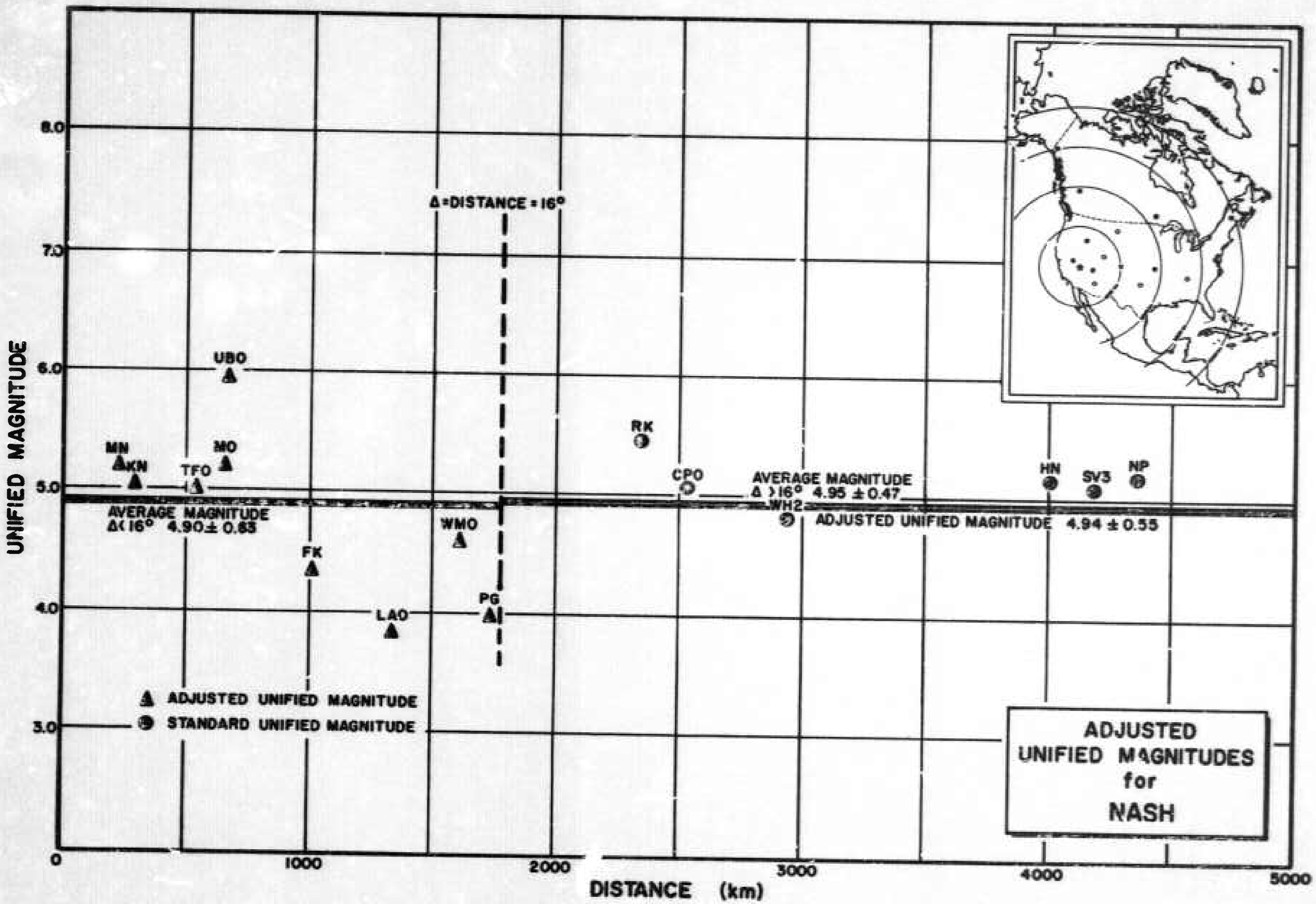
Principal Phases
NASH
19 January 1967
16:45:00.1Z

Code	Station	Distance (km)	Inst.	Magni-fication (k) Film x 10	Phase	Observed Travel Time (min)	(sec)	Period T (sec)	Maximum Amplitude A/T	Magnitude mb	ms	Area (mm²) LPZ
RK-ON	Red Laka, Ontario Canada	2343	SPZ	57.2*	P	4	45.7	0.8	218	5.45		
			SPZ	57.2*	e	4	49.0	0.9	103			
			SPZ	57.2*	e	4	53.6	0.9	80.9			
			SPZ	57.2*	e	5	16.4	0.9	62.5			
			SPT	250	Lg			1.6	55.9			
			LPT		LQ			x x x	x x x			
			LPZ		LR			x x x	x x x			
CPSO-ZS	Cumberland Plateau Observatory, Tennessee	2737	SPZ-8	40	P	5	22.6	0.8	(48.1)	(5.09)		
			SPZ-8	40	e	5	42.0	0.8	39.0			
			SPZ-8	390	(PP)	5	51.2	0.9	17.0			
			SPZ-8	390	PCP	9	00.1	(0.7)	(6.8)			
			SPN	430	Lg			1.4	33.2			
			SPE	420	Lg			1.4	19.6			
			LPN		LQ			x x x	x x x			
			LPZ		LR			x x x	x x x			
WH2YK	Whitahorsa Yukon Territory, Canada	2938	SPZ	195.5	P	5	39.4	0.9	25.1	4.84		
			SPZ	196.5	a	6	13.7	0.9	6.4			
			LPT		LQ			x x x	x x x			
			LPZ		LR			x x x	x x x			
HN-ME	Houlton, Maina	4070	SPZ	85.6	P	7	08.3	0.95	43.2	5.17		
			SPZ	85.6	PCP	9	31.1	0.8	9.7			
			SPT	89.4	Lg			1.6	32.6			
			LPT		LQ			x x x	x x x			
			LPZ		LR			x x x	x x x			
SV3QB	Schaffarvilla, Quebec Canada	4190	SPZ	127	P	7	(16.2)	1.2	37.9	5.08		
			LPZ		LR			x x x	x x x			
MP-NT	Mould Bay, Northweat Territo-ias, Canada	4363	SPZ	240	P	7	30.6	0.9	61.4	5.19		
			SPZ	240	a	7	36.3	0.8	29.0			
			SPZ	240	a	9	12.6	1.5	13.9			
			SPZ	240	PCP		39.7	0.8	10.0			
			SPT	303	Lg			2.5	91.7			
			LPZ	10.8	LR			16.0	37.1			58.33

A/T mμ/sec
( ) Doubtful values or phases
* Measurements made from playouts
--- Maximum Amplitude clipped on film & tape
x x x Signal, if present, obscured by earthquake

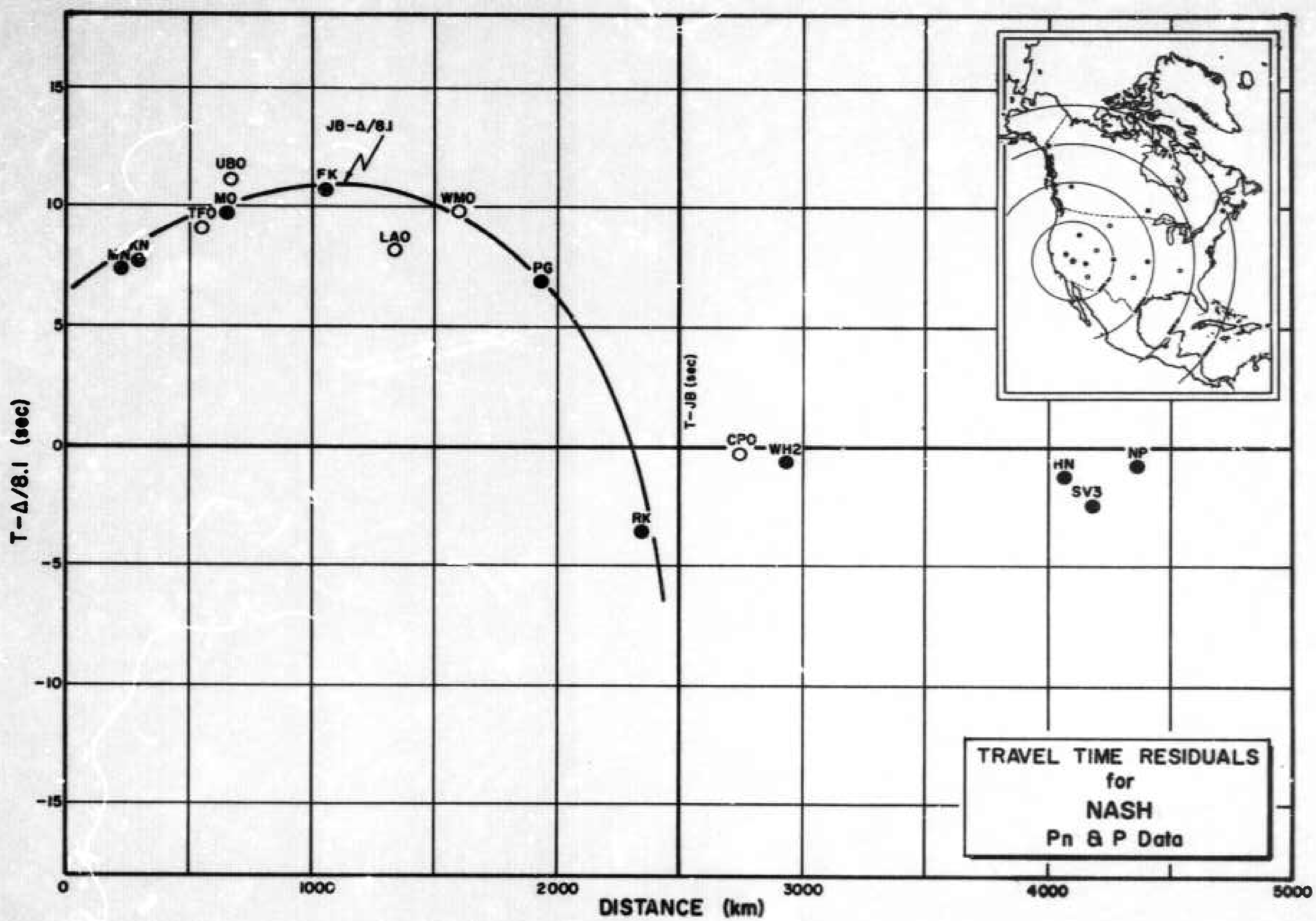

UNIFIED MAGNITUDES
for
NASH
UNIFIED MAGNITUDE
DISTANCE (km)
0
1000
2000
3000
4000
500
3.0
4.0
5.0
6.0
7.0
8.0
Δ = DISTANCE = 16°
AVERAGE MAGNITUDE
Δ<16° 5.49 ± 0.41
AVERAGE UNIFIED MAGNITUDE 5.25±0.50
AVERAGE MAGNITUDE
Δ>16° 4.97 ± 0.47
MN
KN
TFO
MO
UBO
FK
LAO
WMO
PG
RK
CPO
WH2
HN
SV3
NP

Figure



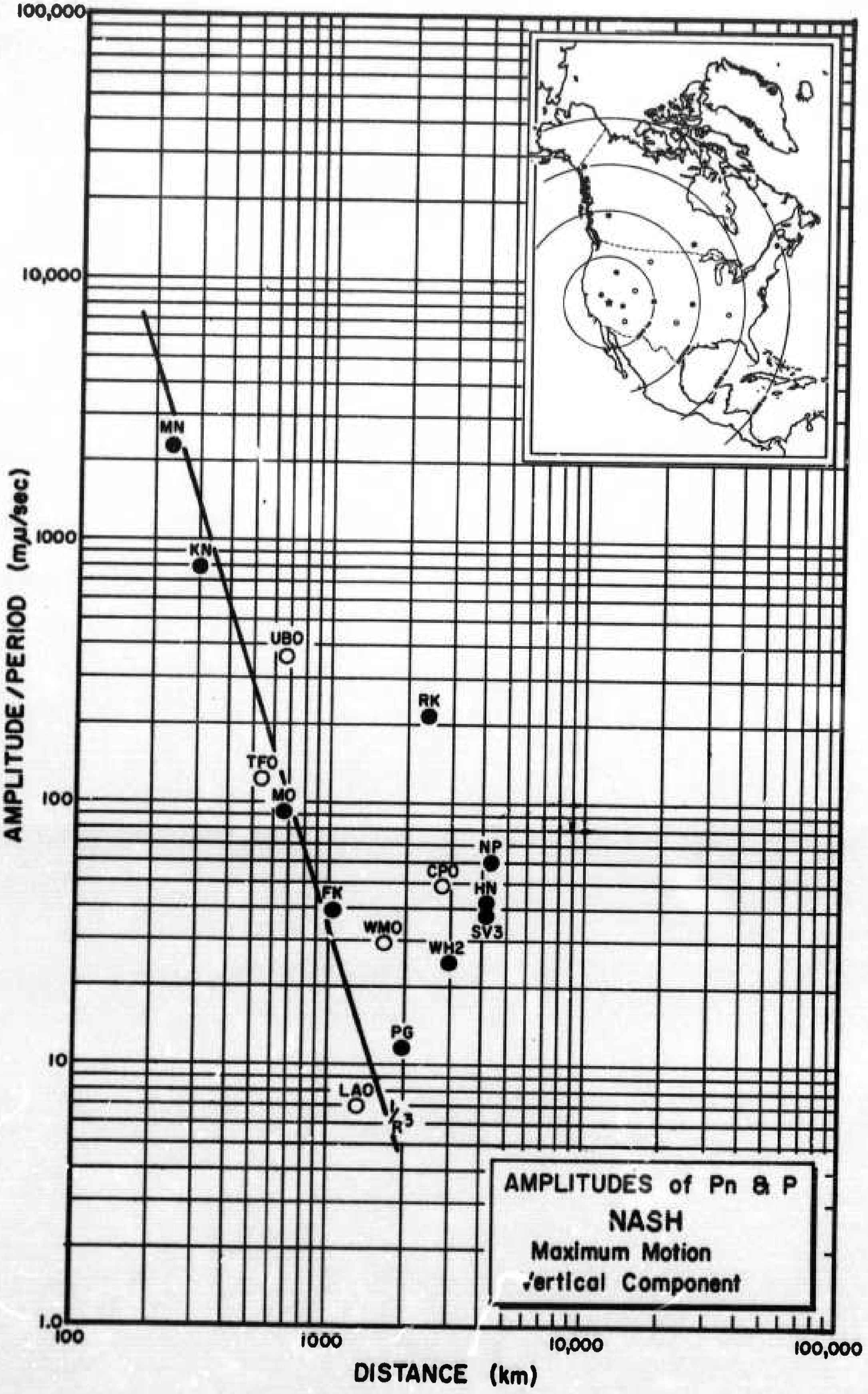
UNIFIED MAGNITUDE
8.0
7.0
6.0
5.0
4.0
3.0
0
1000
2000
3000
4000
5000
DISTANCE (km)
Δ=DISTANCE=16°
UBO
MN
KN
MO
TFO
FK
LAO
WMO
PG
RK
CPO
WH2
HN
SV3
NP
AVERAGE MAGNITUDE
Δ<16° 4.90± 0.83
AVERAGE MAGNITUDE
Δ>16° 4.95 ± 0.47
ADJUSTED UNIFIED MAGNITUDE 4.94 ± 0.55
ADJUSTED UNIFIED MAGNITUDE
STANDARD UNIFIED MAGNITUDE
ADJUSTED
UNIFIED MAGNITUDES
for
NASH

Figure 3



TRAVEL TIME RESIDUALS
for
NASH
Pn & P Data
T-Δ/8.1 (sec)
DISTANCE (km)
T-JB (sec)
JB-Δ/8.1
UBO
FK
MO
TFO
KN
WMO
LAO
PG
RK
CPO
WH2
HN
SV3
NP

Figure 4



AMPLITUDE/PERIOD (mμ/sec)
DISTANCE (km)
100,000
10,000
1000
100
10
1.0
100
1000
10,000
100,000
MN
KN
UBO
RK
TFO
MO
FK
WMO
CPO
NP
HN
SV3
WH2
PG
LAO
AMPLITUDES of Pn & P
NASH
Maximum Motion
Vertical Component

Figure 5

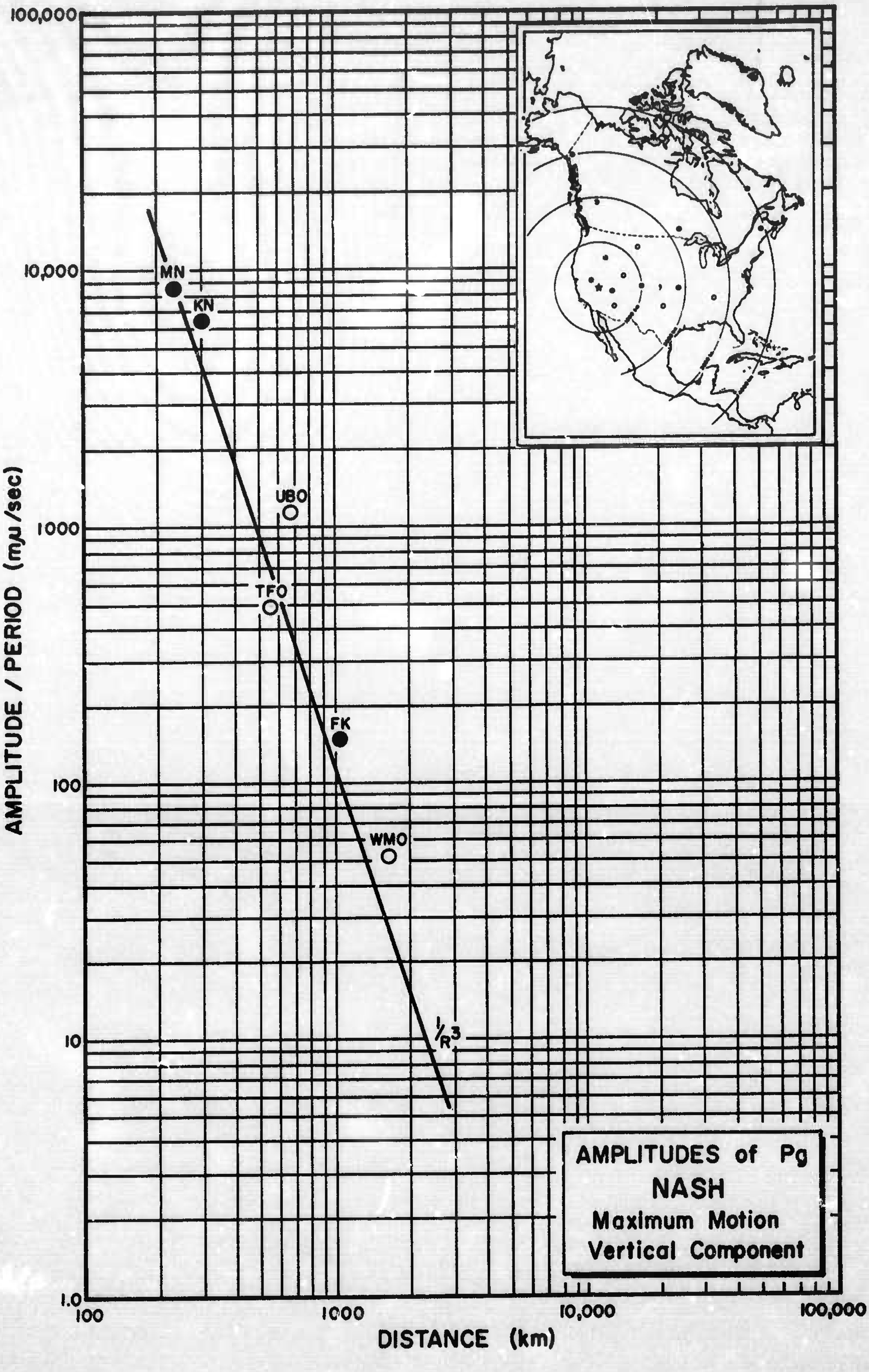
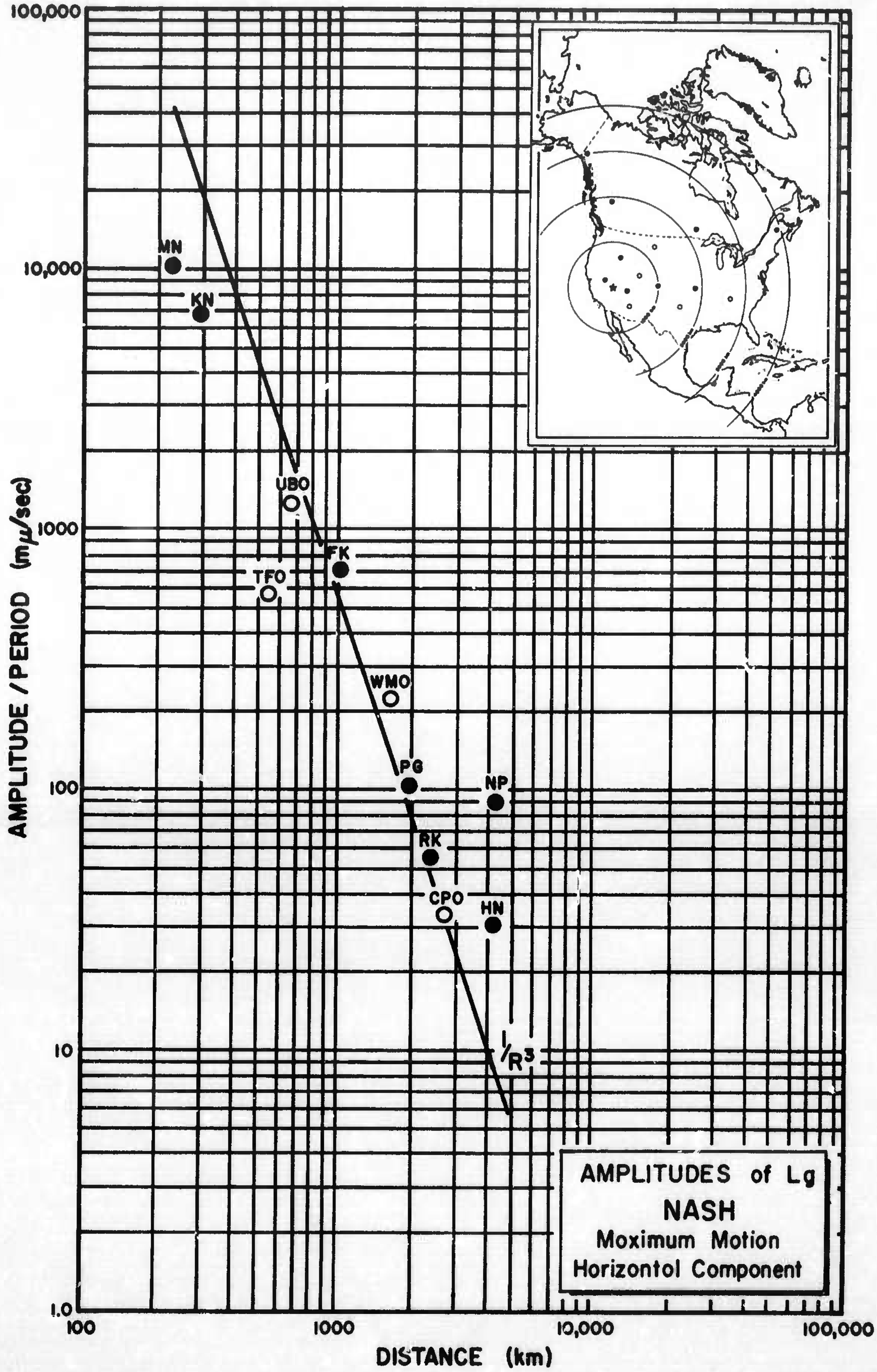

100,000
10,000
1000
100
10
1.0
100
1000
10,000
100,000
AMPLITUDE / PERIOD (mμ/sec)
DISTANCE (km)
MN
KN
UBO
TFO
FK
WMO
$1/R^3$
AMPLITUDES of Pg
NASH
Maximum Motion
Vertical Component

Figure 6



100,000
10,000
1000
100
10
1.0
100
1000
10,000
100,000
AMPLITUDE / PERIOD (mμ/sec)
DISTANCE (km)
MN
KN
UBO
TFO
FK
WMO
PG
NP
RK
CPO
HN
1/R3
AMPLITUDES of Lg
NASH
Moximum Motion
Horizontol Component

Figure 7

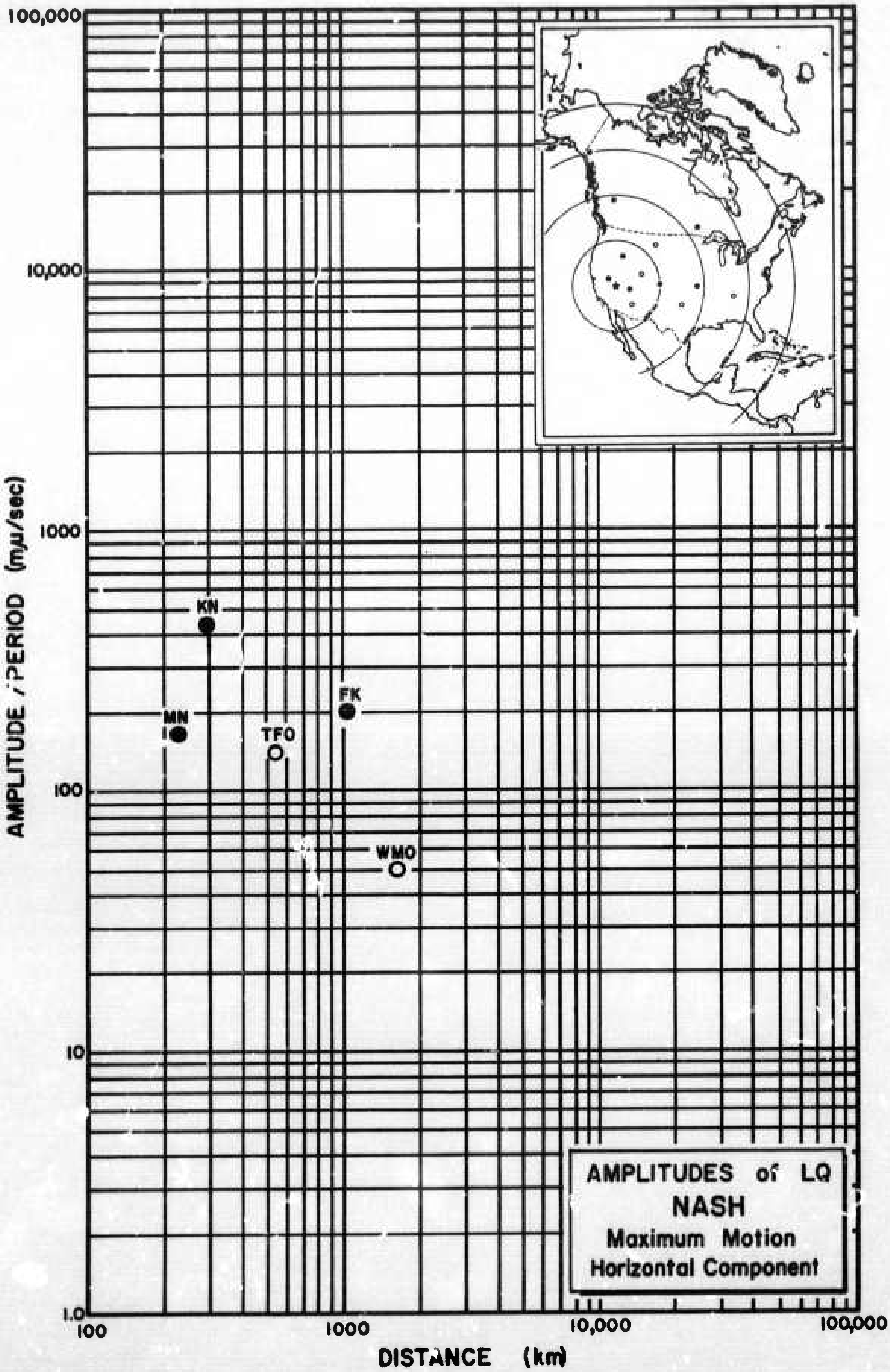

100,000
10,000
1000
100
10
1.0
AMPLITUDE / PERIOD (mμ/sec)
KN
MN
TFO
FK
WMO
100
1000
10,000
100,000
DISTANCE (km)
AMPLITUDES of LQ
NASH
Maximum Motion
Horizontal Component

Figure 8

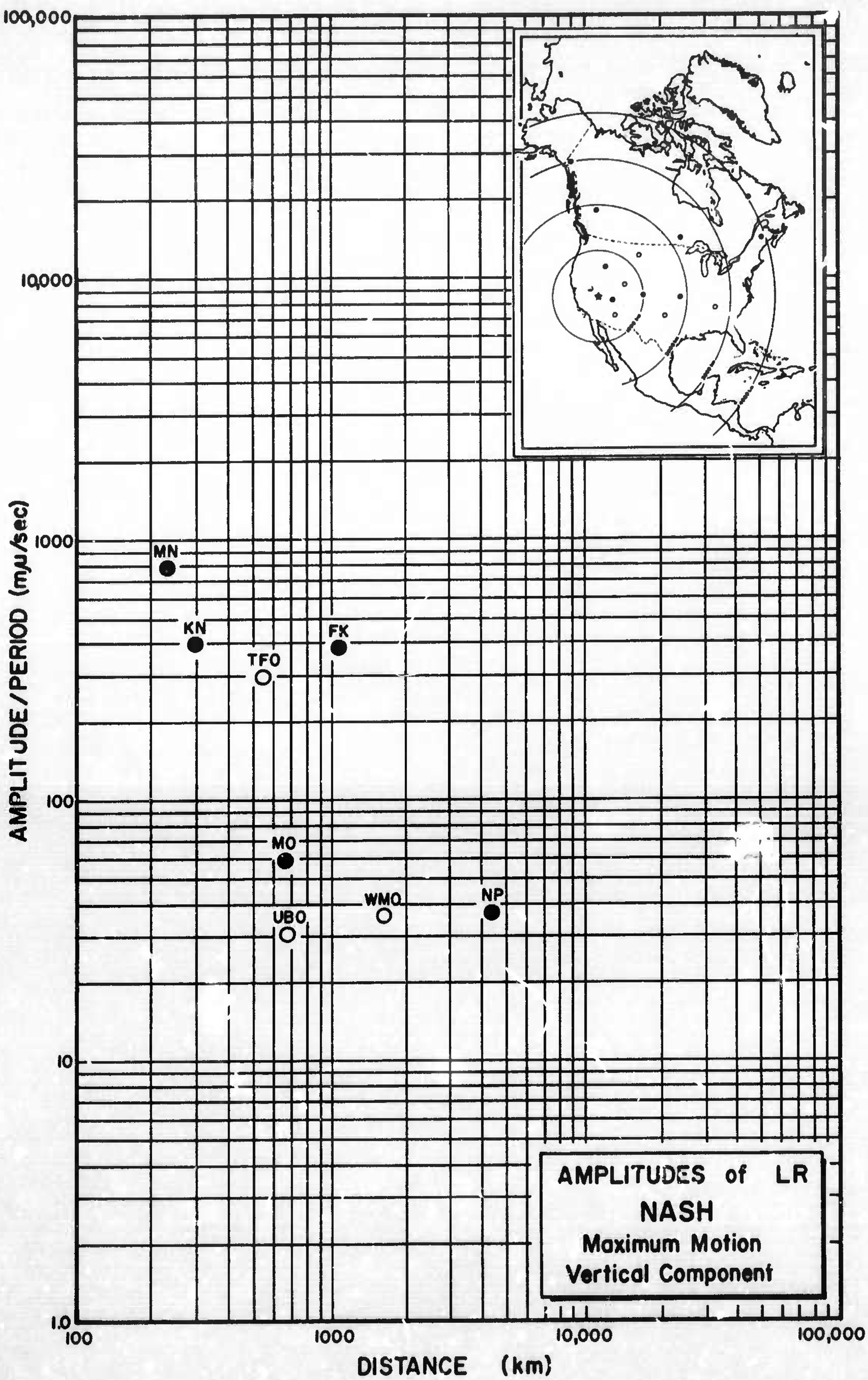

AMPLITUDES of LR
NASH
Maximum Motion
Vertical Component
AMPLITUDE/PERIOD (mμ/sec)
DISTANCE (km)
100,000
10,000
1000
100
10
1.0
100
1000
10,000
100,000
MN
KN
FK
TFO
MO
WMO
NP
UBO

Figure 9

Code	Station	Distance (km)	Geographic Latitude	Geographic Longitude	Elev. (km)	Computed Azimuth		Installed Azimuth		Large or Small SP	LP Inst.
						Epi. Sta.	Sta. Epi.	Radial	Tang.		
*MN-NV	Mina, Nevada	228	38°26'10" N	118°08'53" W	1.52	310°	128°	308°	38°	L	X
*KN-UT	Kanab, Utah	294	37°01'22" N	112°49'39" W	1.74	92°	274°	95°	185°	L	X
TFSO-Z60	Tonto Forest Observatory, Arizona	543	34°17'12" N	111°16'03" W	1.49	124°	307°	90°	0°	JM	X
*MO-ID	Mountain Home, Idaho	659	43°04'19" N	116°15'56" W	0.79	359°	179°	359°	89°	L	X
UBSO-Z10	Uinta Basin Observatory, Utah	671	40°19'18" N	109°34'07" W	1.60	56°	240°	90°	0°	JM	X
*FK-CO	Franktown, Colorado	1055	39°35'12" N	104°27'42" W	1.80	72°	259°	79°	169°	L	X
LAO	Subarray AO-10,Montana	1340	46°41'19" N	106°13'20" W	.90	35°	221°	0°	90°	HSZ	X
WMSO-Z6	Wichita Mountain Observatory, Oklahoma	1604	34°43'05" N	98°35'21" W	.51	94°	285°	90°	0°	JM	X
KC-MO	Kansas City, Missouri	1891	39°21'21" N	94°40'17" W	.27	76°	269°	M O V I N G			
PG-BC	Prince George,British Columbia, Canada	1938	53°59'50" N	122°31'23" W	.91	347°	163°	110°	200°	L	X
*RK-ON	Red Lake,Ontario,Canada	2343	50°50'20" N	93°40'20" W	.37	42°	238°	58°	148°	S	X
CPSO-Z8	Cumberland Plateau Observatory, Tennessee	2737	35°35'41" N	85°34'13" W	.57	84°	283°	90°	0°	JM	X
*WH2YK	Whitehorse, Yukon Territory, Canada	2938	60°41'41" N	134°58'02" W	.85	339°	145°	325°	55°	L	X
*HN-ME	Houlton, Maine	4070	46°09'43" N	67°59'09" W	.21	60°	273°	93°	183°	S	X
SV3QB	Schefferville,Quebec, Canada	4190	54°48'39" N	66°45'00" W	[illegible]	46°	263°	139°	129°	S	X
*NP-NT	Mould Bay, Northwest Territories, Canada	4363	76°15'08" N	119°22'18" W	.06	359°	196°	356°	086°	JMZ S	X

*Seismometers Orientated Toward Nevada Test Site

Recording Site Information - NASH
Appendix I(A)

Unified Magnitude: $m = \log_{10} (A/T), + B$

where

A = zero to peak ground motion in millimicrons $= \frac{(mm)\ (1000)}{K}$

T = signal period in seconds

B = distance factor (see Table below)

mm = record amplitude in millimeters zero to peak

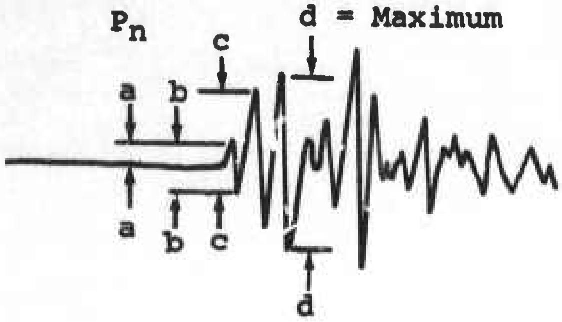
K = magnification in thousands at signal frequency

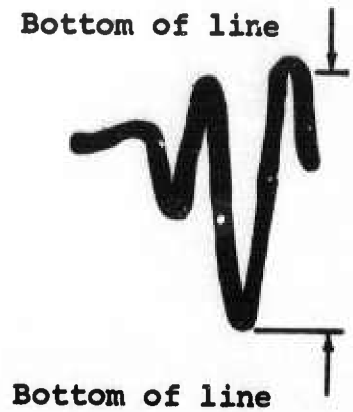
Table of Distance Factors (B) for Zero Depth

Dist (deg)	B	Dist (deg)	B	Dist (deg)	B	Dist (deg)	B
0°	-	27°	3.5	54°	3.8	80°	3.7
1	-	28	3.6	55	3.8	81	3.8
2	2.2	29	3.6	56	3.8	82	3.9
3	2.7	30	3.6	57	3.8	83	4.0
4	3.1	31	3.7	58	3.8	84	4.0
5	3.4	32	3.7	59	3.8	85	4.0
6	3.6	33	3.7	60	3.8	86	3.9
7	3.8	34	3.7	61	3.9	87	4.0
8	4.0	35	3.7	62	4.0	88	4.1
9	4.2	36	3.6	63	3.9	89	4.0
10	4.3	37	3.5	64	4.0	90	4.0
11	4.2	38	3.5	65	4.0	91	4.1
12	4.1	39	3.4	66	4.0	92	4.1
13	4.0	40	3.4	67	4.0	93	4.2
14	3.6	41	3.5	68	4.0	94	4.1
15	3.3	42	3.5	69	4.0	95	4.2
16	2.9	43	3.5	70	3.9	96	4.3
17	2.9	44	3.5	71	3.9	97	4.4
18	2.9	45	3.7	72	3.9	98	4.5
19	3.0	46	3.8	73	3.9	99	4.5
20	3.0	47	3.9	74	3.8	100	4.4
21	3.1	48	3.9	75	3.8	101	4.3
22	3.2	49	3.8	76	3.9	102	4.4
23	3.3	50	3.7	77	3.9	103	4.5
24	3.3	51	3.7	78	3.9	104	4.6
25	3.5	52	3.7	79	3.8	105	4.7
26	3.4	53	3.7				

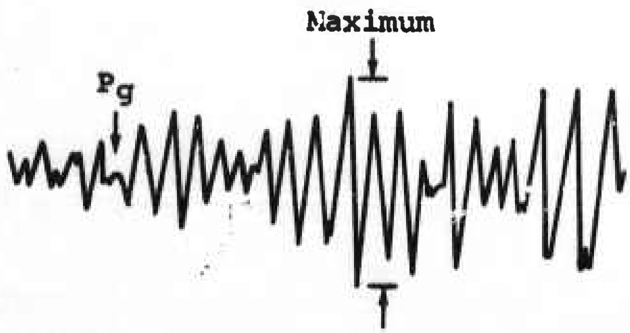
Unified Magnitudes From P_n or P Waves

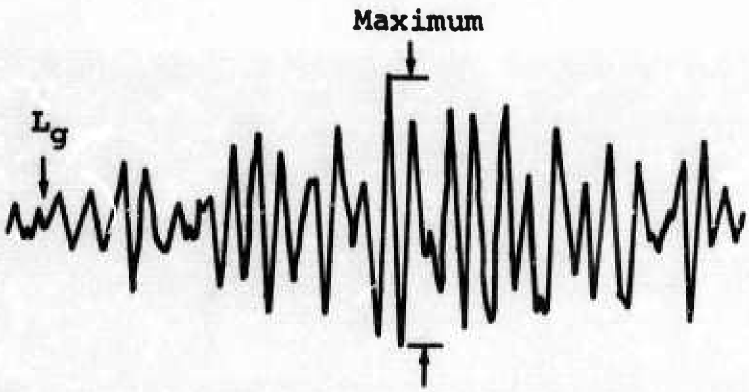
Appendix I(B)





Detail Showing Allowance For Line Width





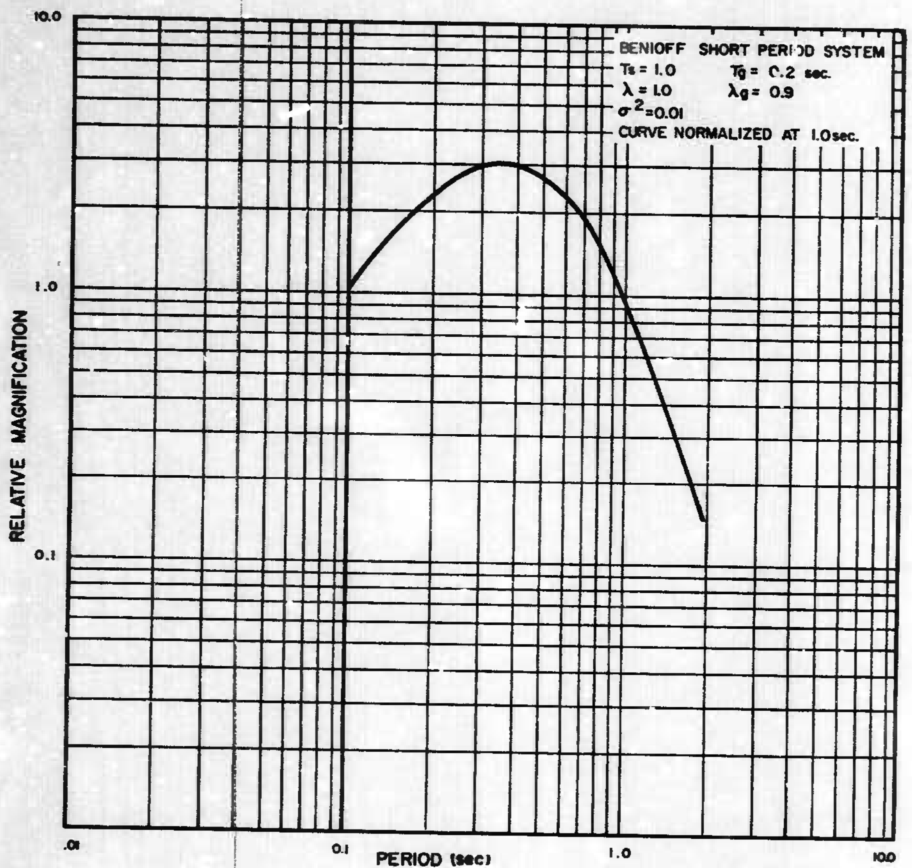
Pick time of Pn at beginning of "a" half cycle.

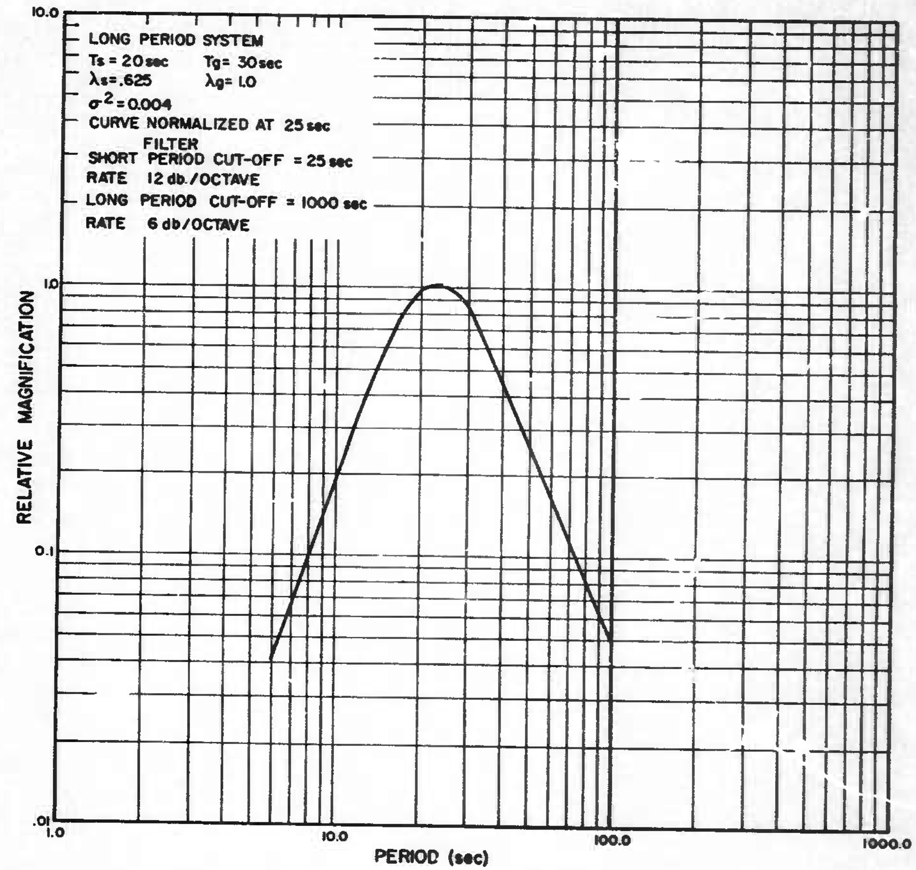
Pick amplitude of Pn as maximum "$d/2$" within 2 or 3 cycles of "c".

Pick amplitudes of Pg and Lg at maximum of corresponding motion.

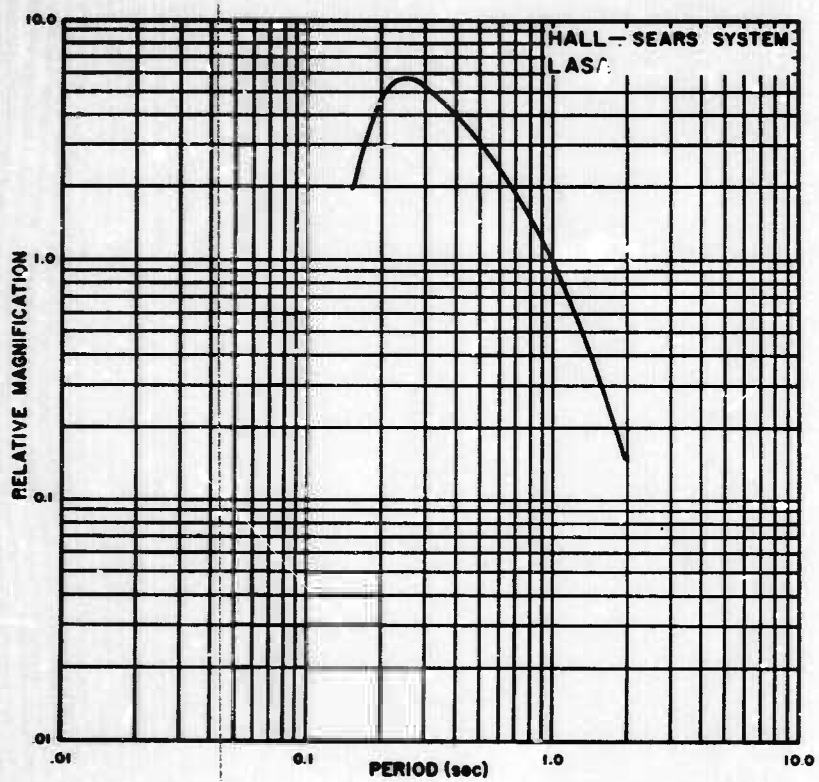
Seismic Analysis Diagram

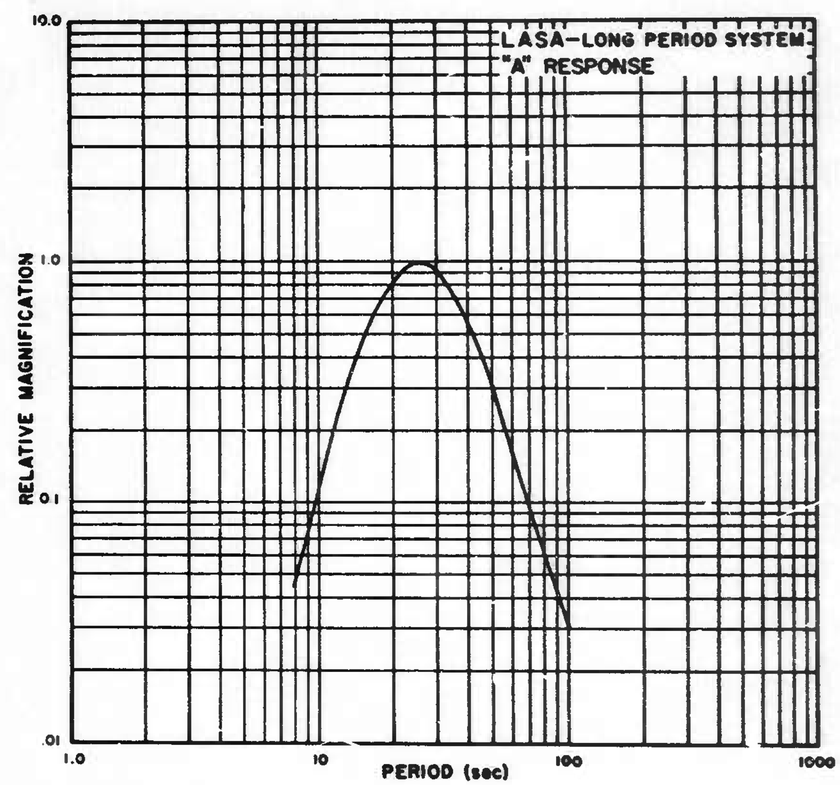
APPENDIX II(A)





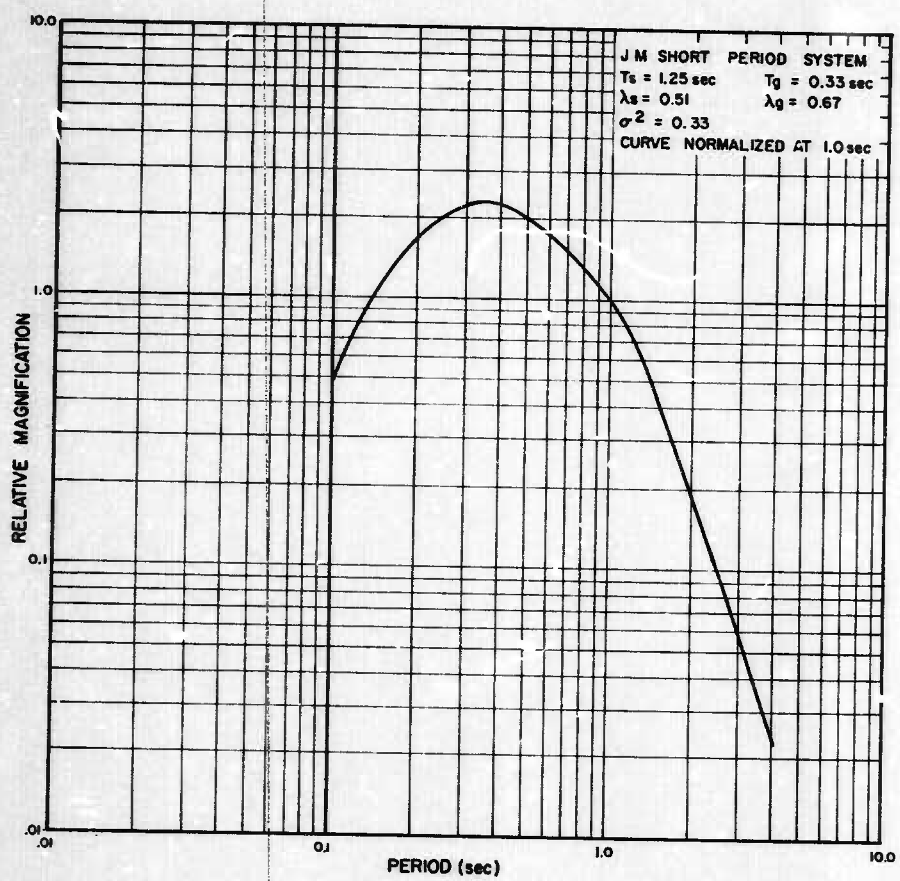
INSTRUMENT RESPONSE CURVES - LRSM

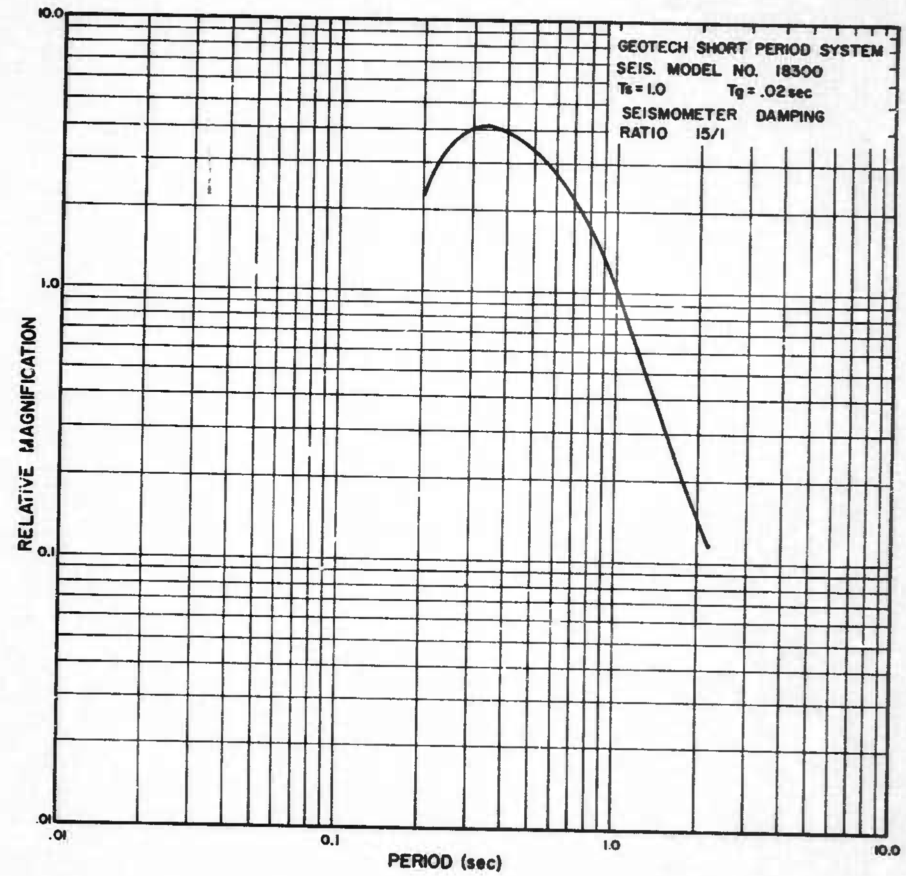




INSTRUMENT RESPONSE CURVE - LASA

APPENDIX II(C)





INSTRUMENT RESPONSE CURVES - OTHER SHORT PERIOD

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3. REPORT TITLE

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4. DESCRIPTIVE NOTES (Type of report and inclusive dates)

Scientific

5. AUTHOR(S) (Last name, first name, initial)

Clark, Don M.

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13. ABSTRACT

An analysis of seismological data from an underground nuclear explosion as a continuing study to provide information to aid in distinguishing between earthquakes and explosions. A table of travel-times and amplitudes of P, Pg, Lg, and surface waves are included along with other unidentified phases.

DD FORM 1 JAN 64 1473

Security Classification

Unclassified
Security Classification

14 KEY WORDS	LINK A		LINK B		LINK C	
	ROLE	WT	ROLE	WT	ROLE	WT
Seismic Magnitude Seismic Travel-Time Seismic Amplitude VELA-UNIFORM Nuclear Tests						

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GPO 886-551

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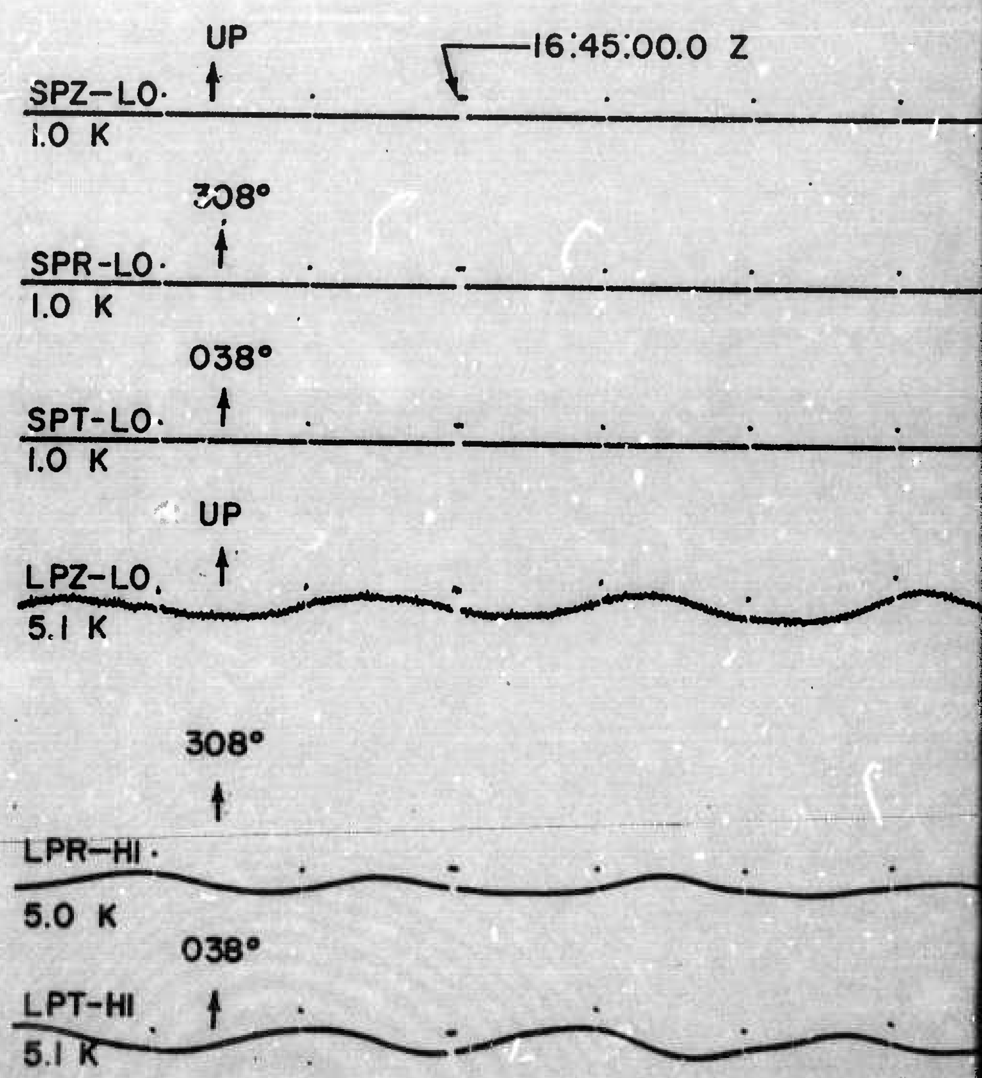
Security Classification



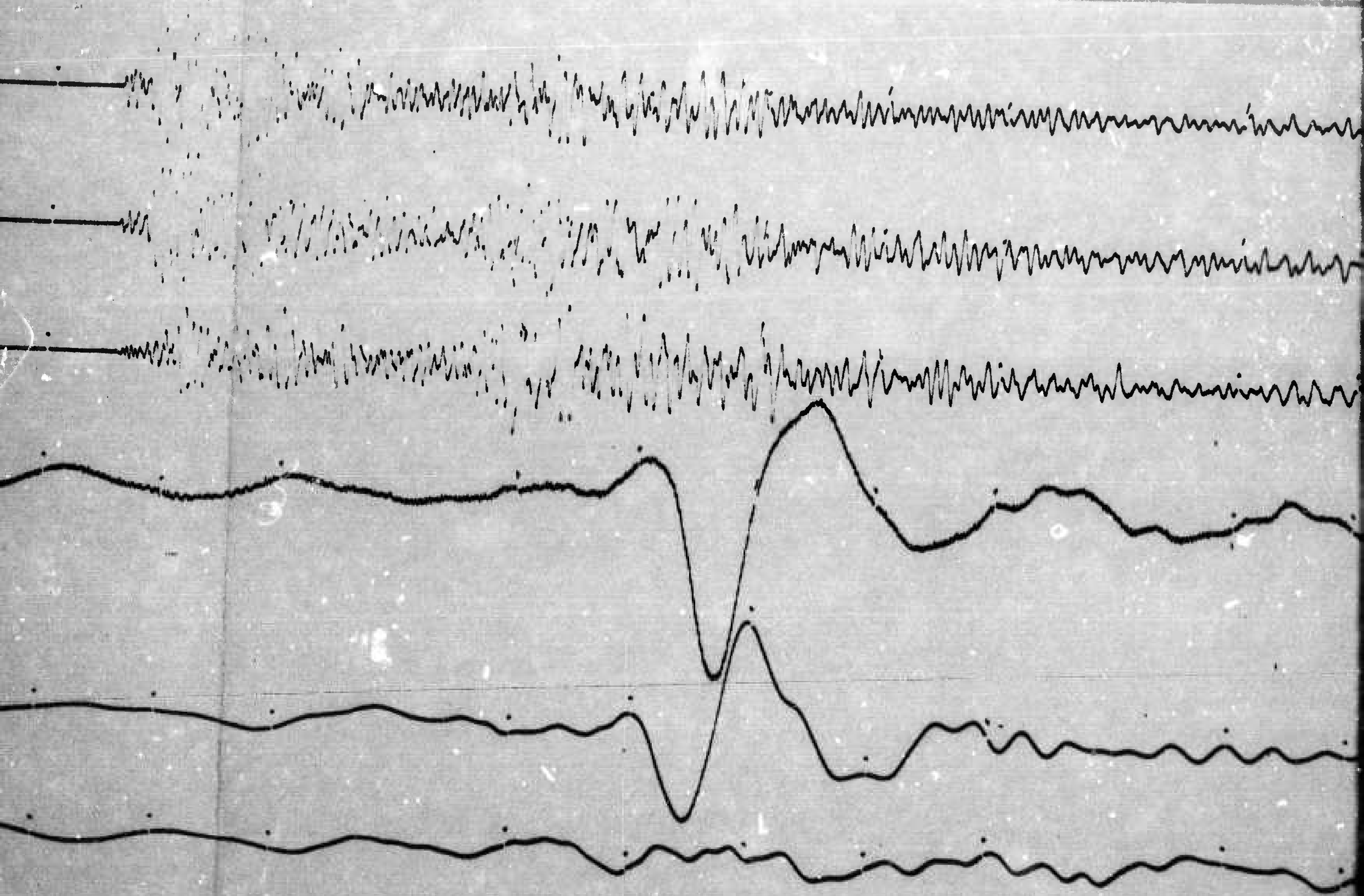
NASH

MN-NV

MINA, NEVADA

19 JANUARY 1967

Δ = 228 km



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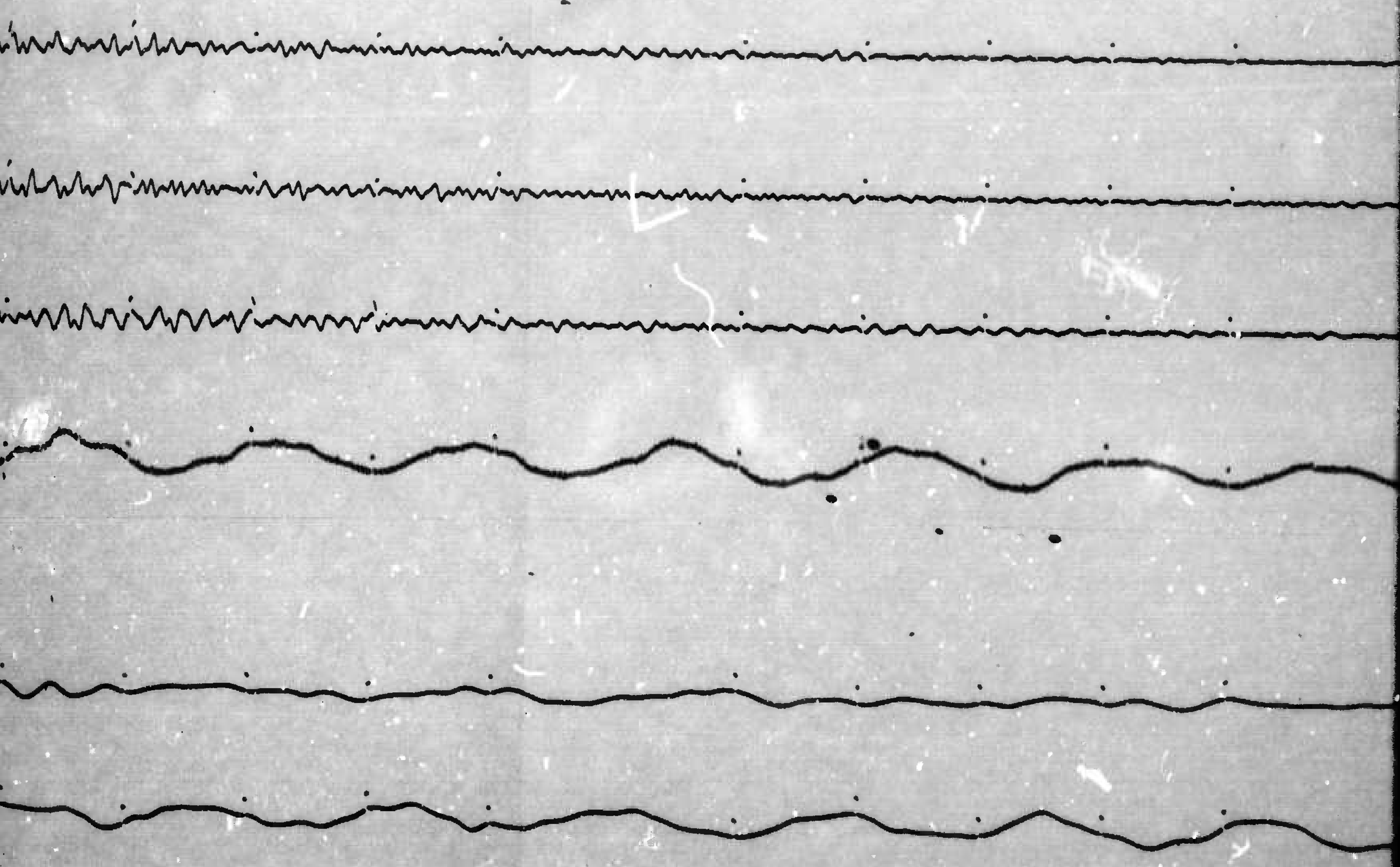

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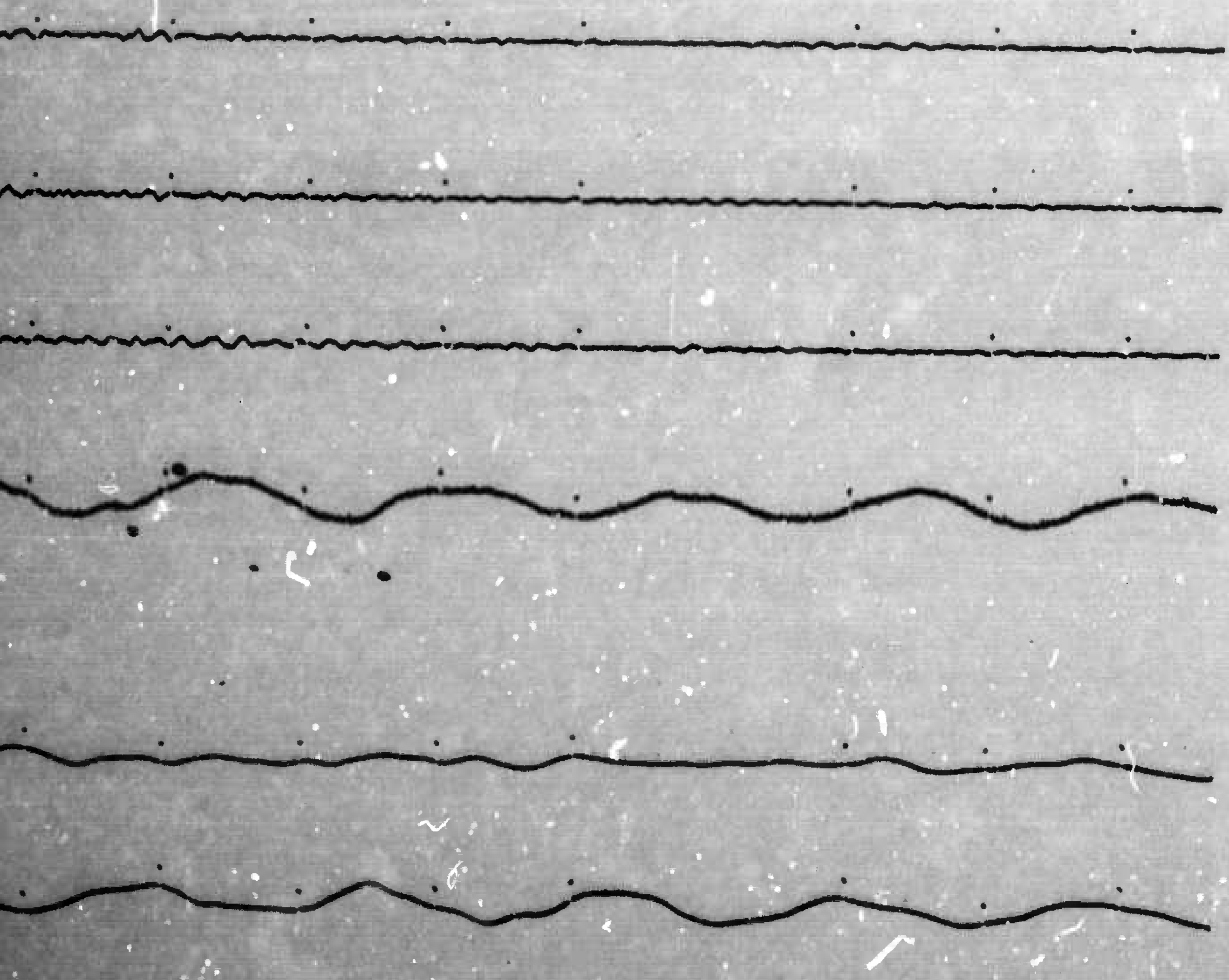

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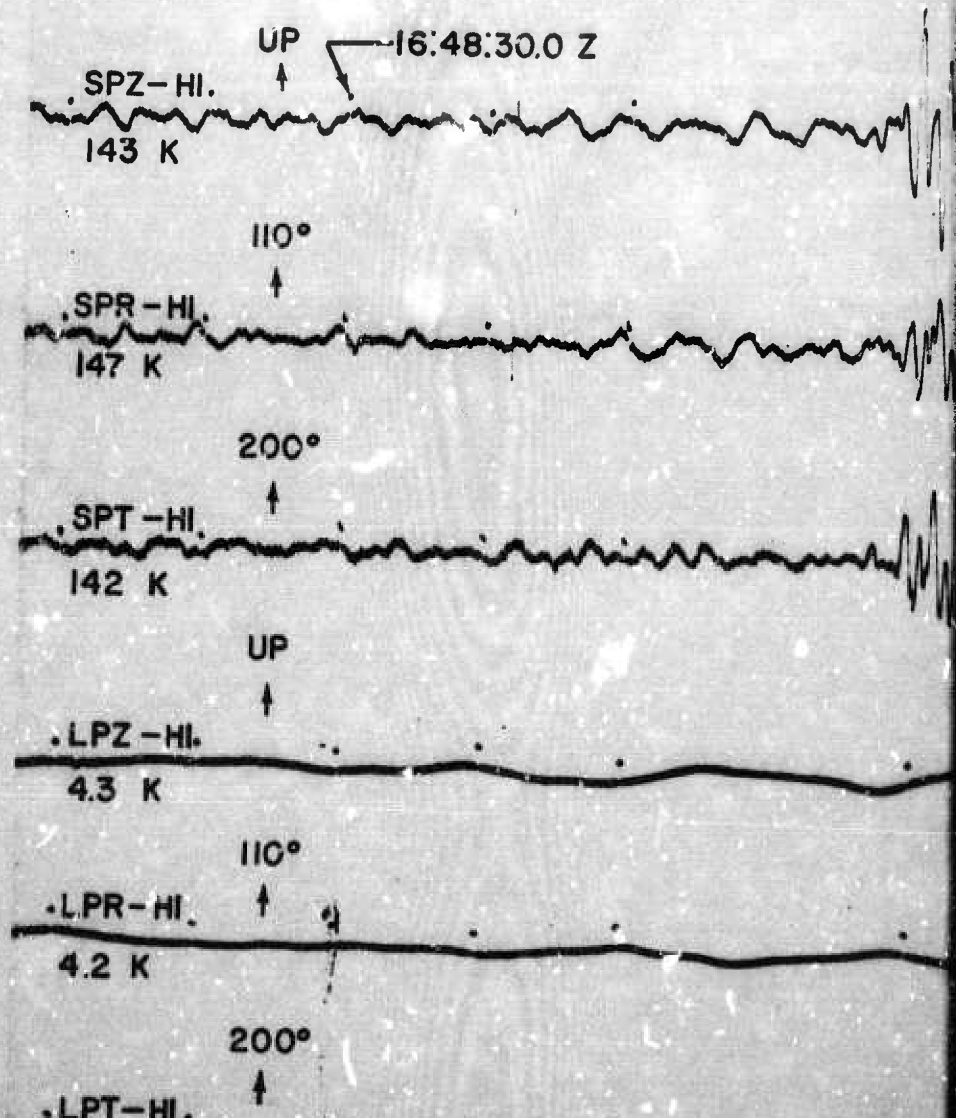


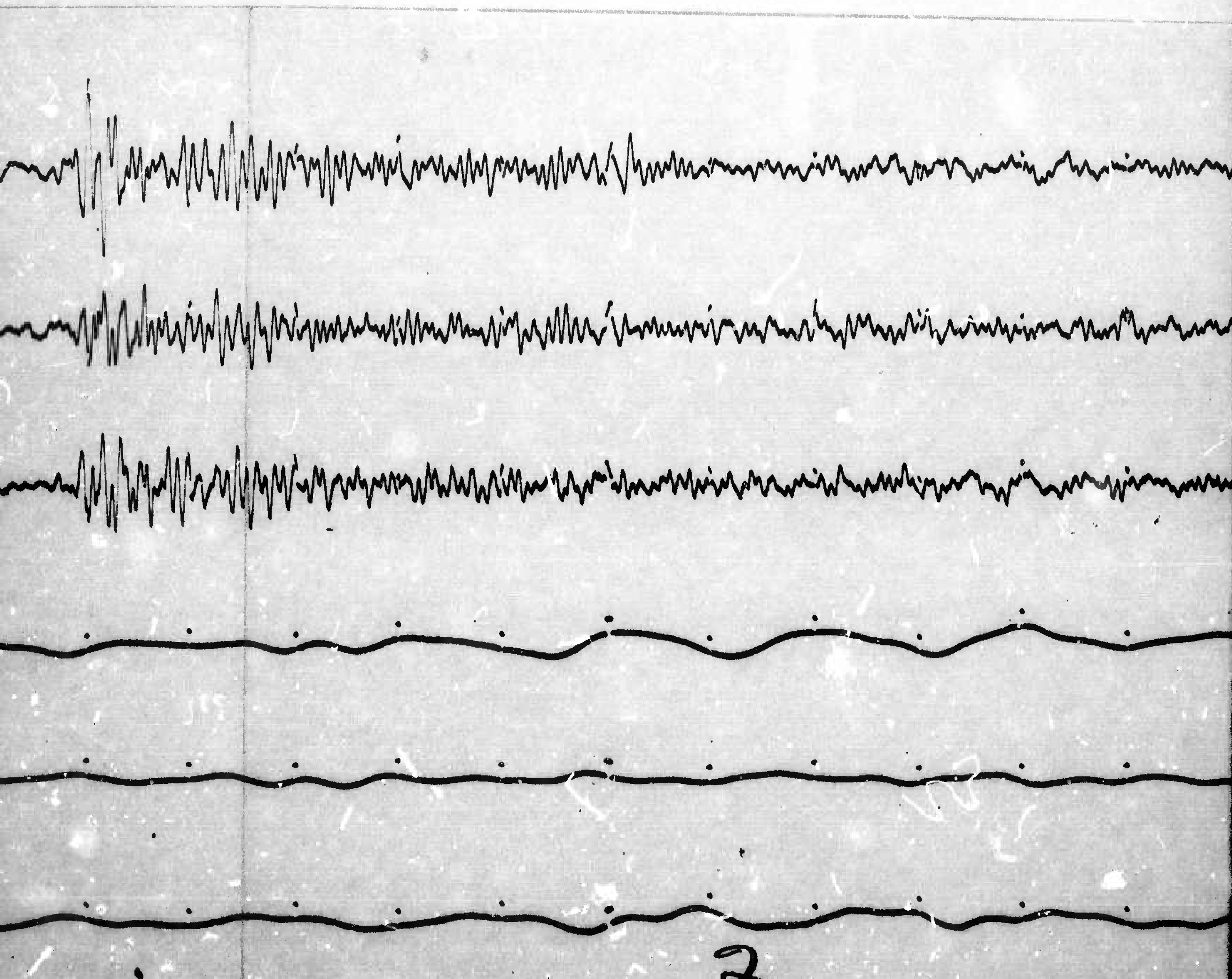
NASH

PG-BC

PRINCE GEORGE, BRITISH COLUMBIA

19 JANUARY 1967

Δ = 1938 km



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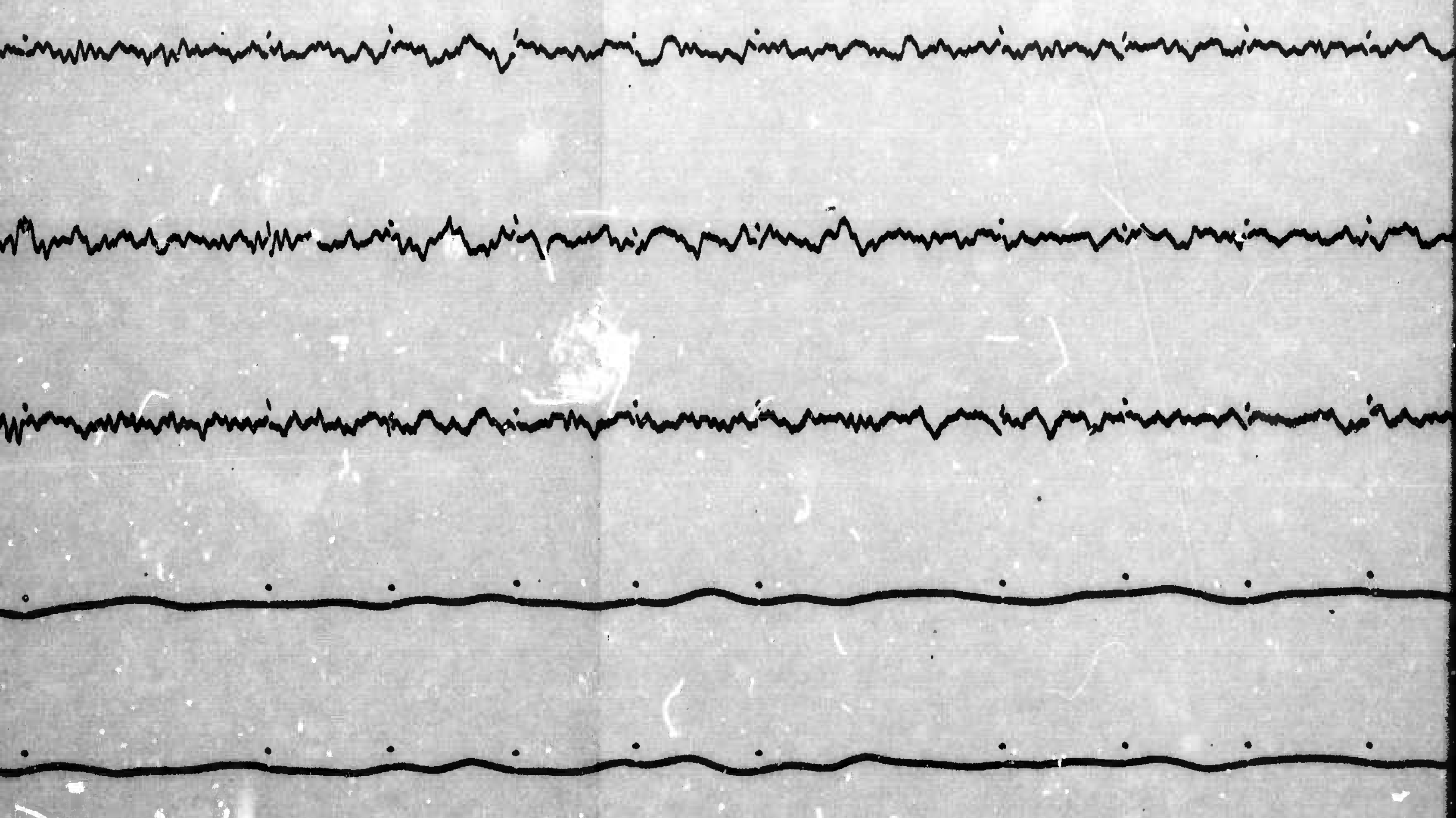

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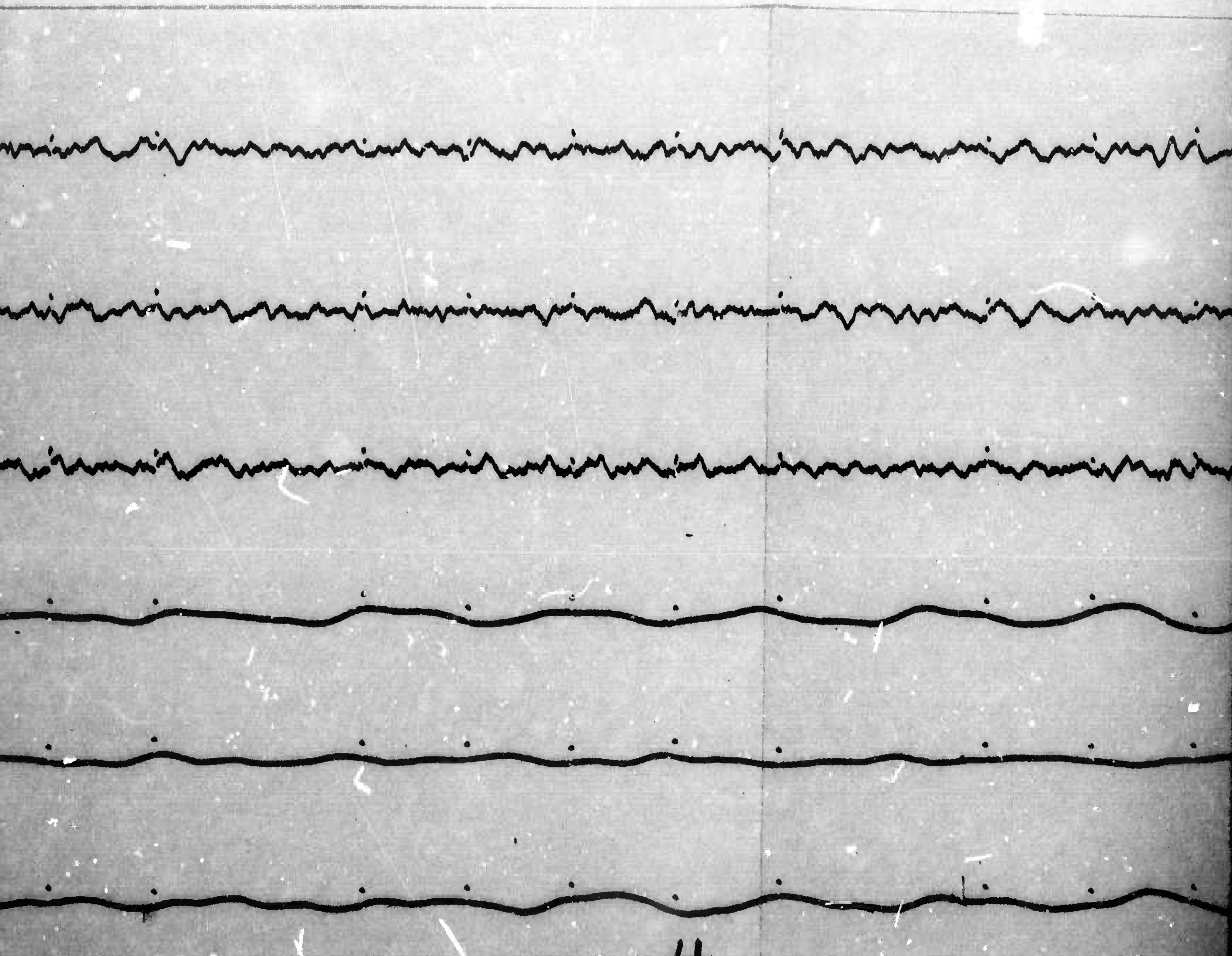

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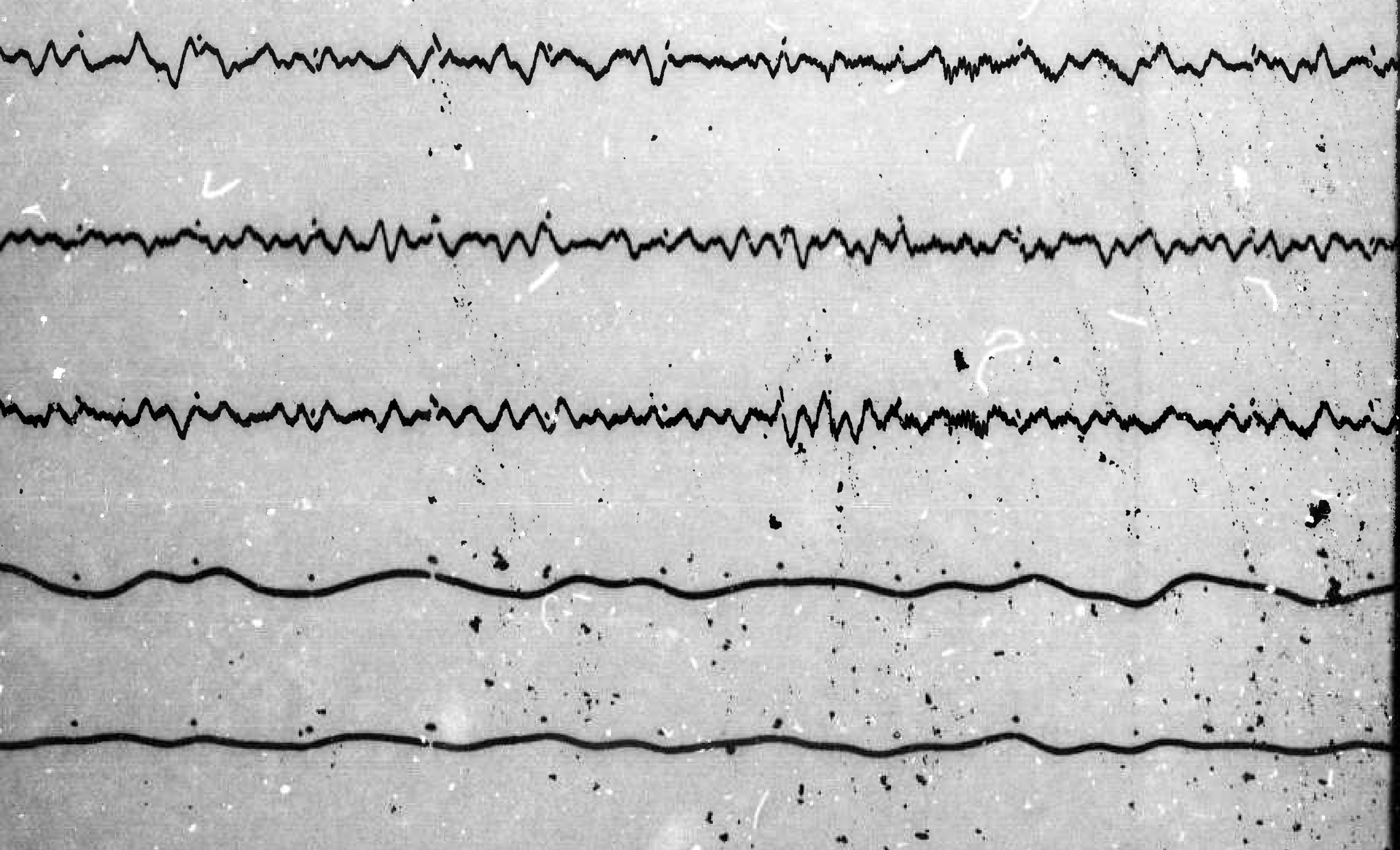

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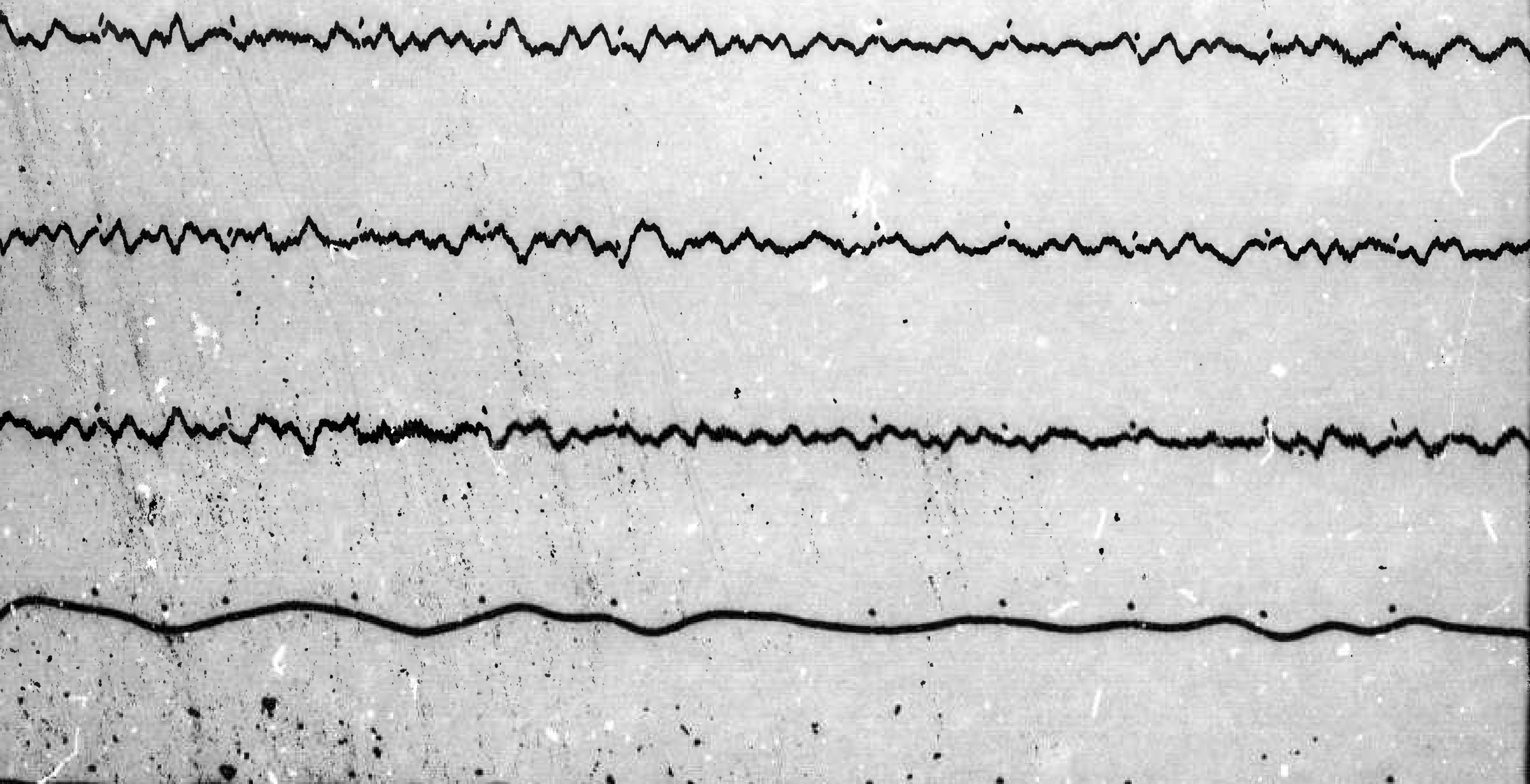

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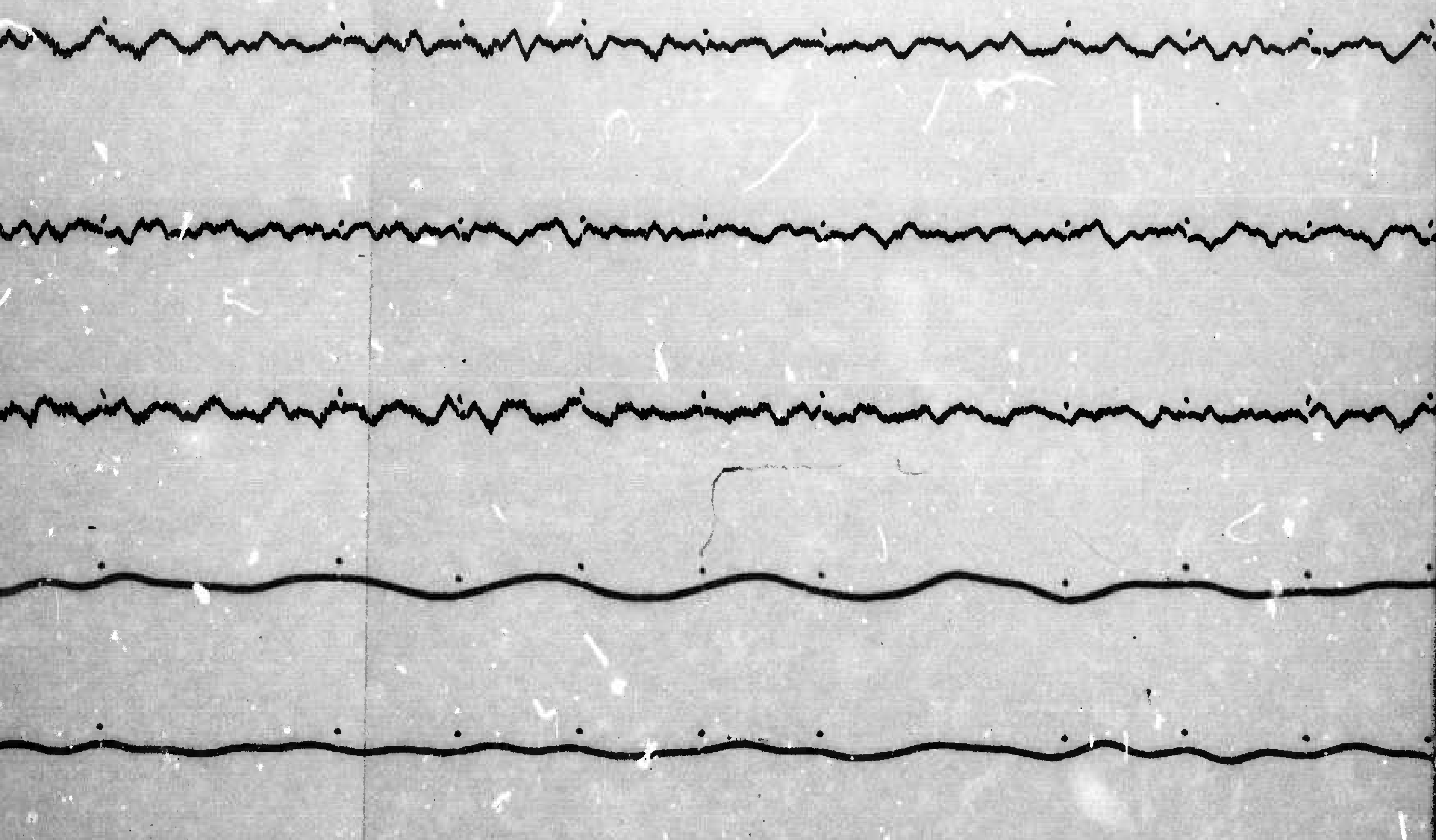

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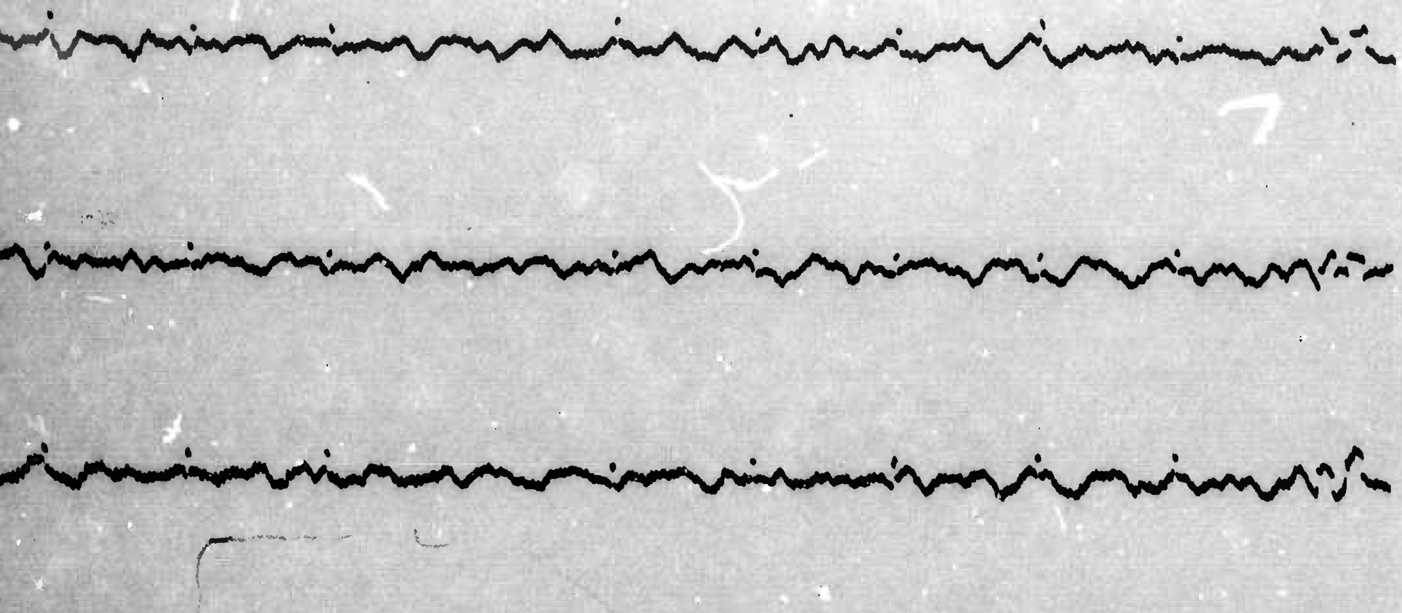

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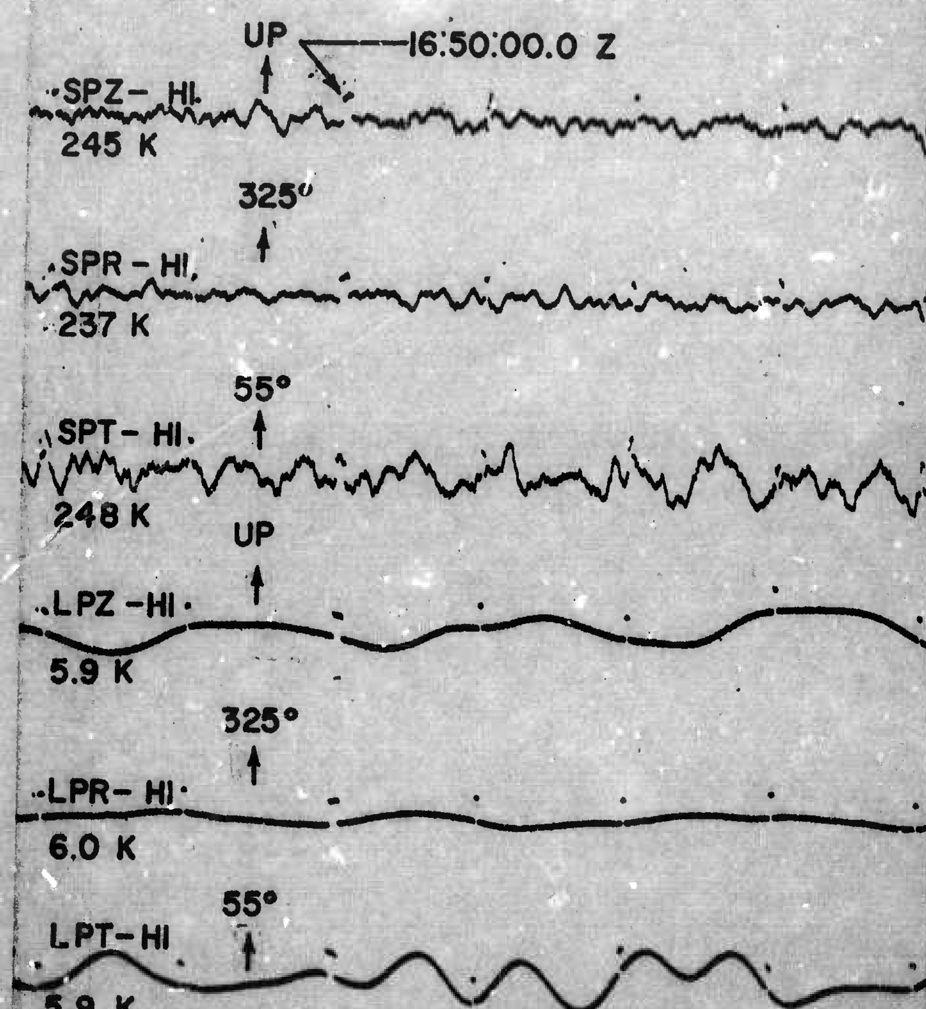


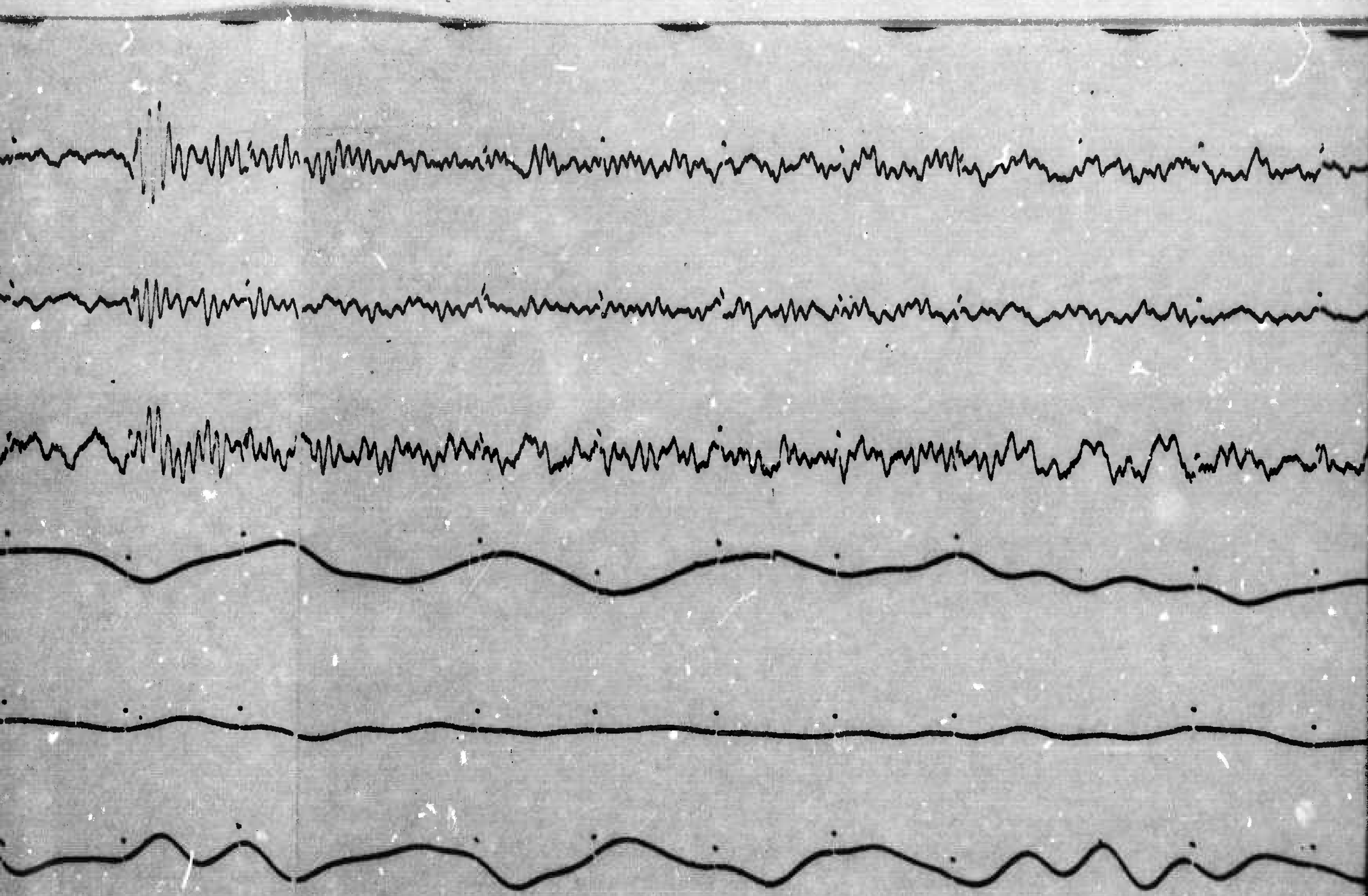
NASH

WH2YK

WHITEHORSE, YUKON TERRITORY

19 JANUARY 1967

Δ = 2938 km



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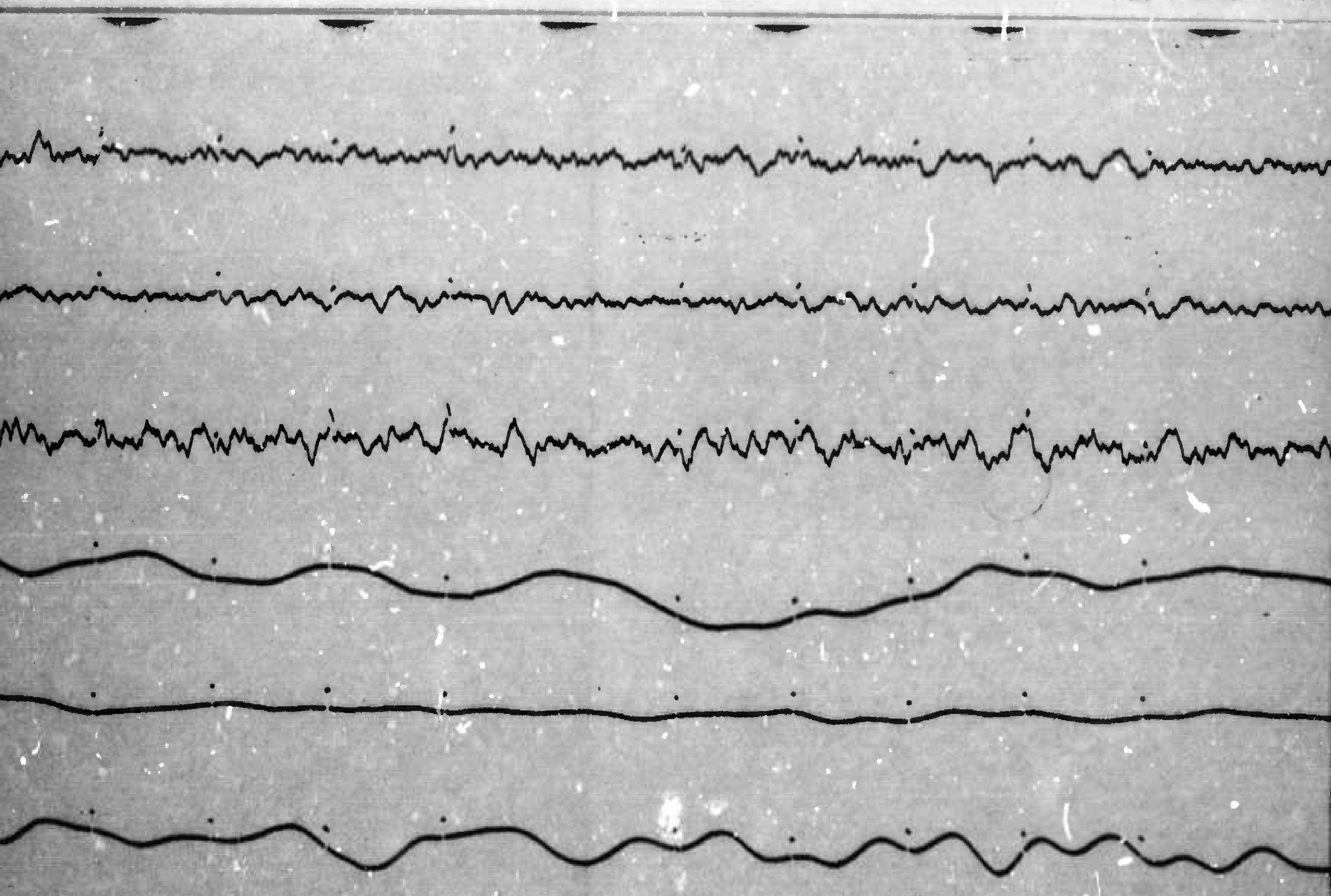

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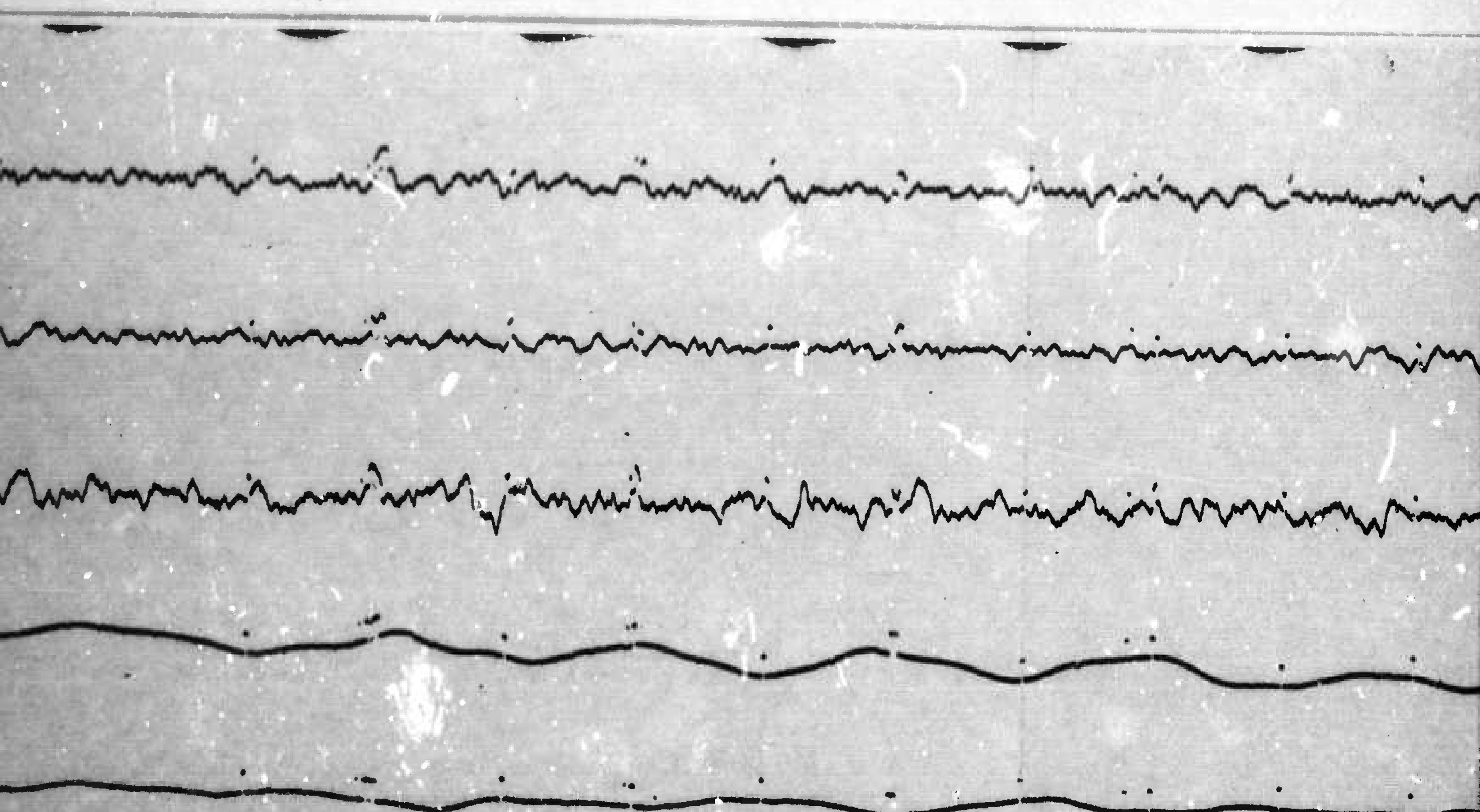

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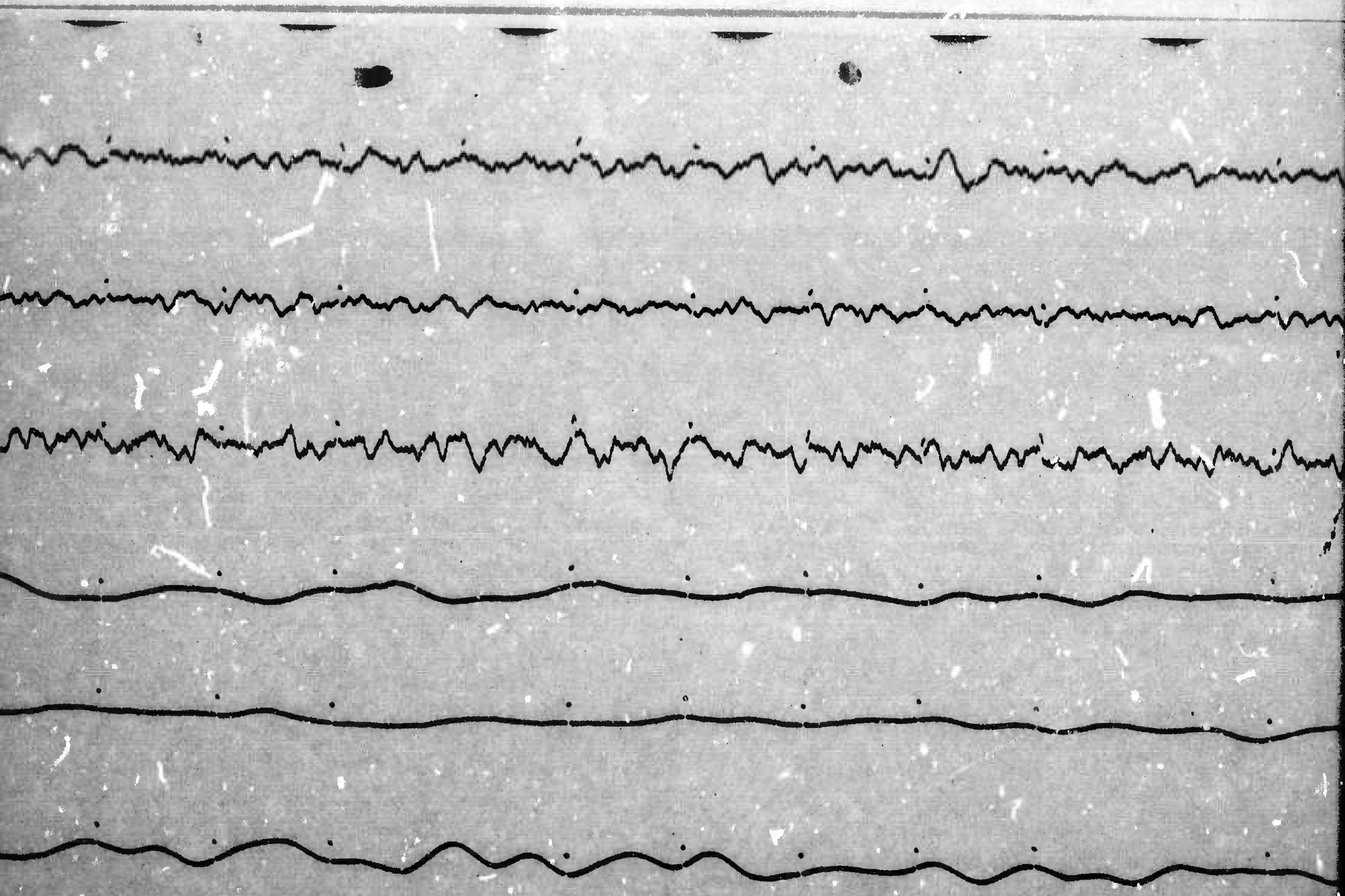

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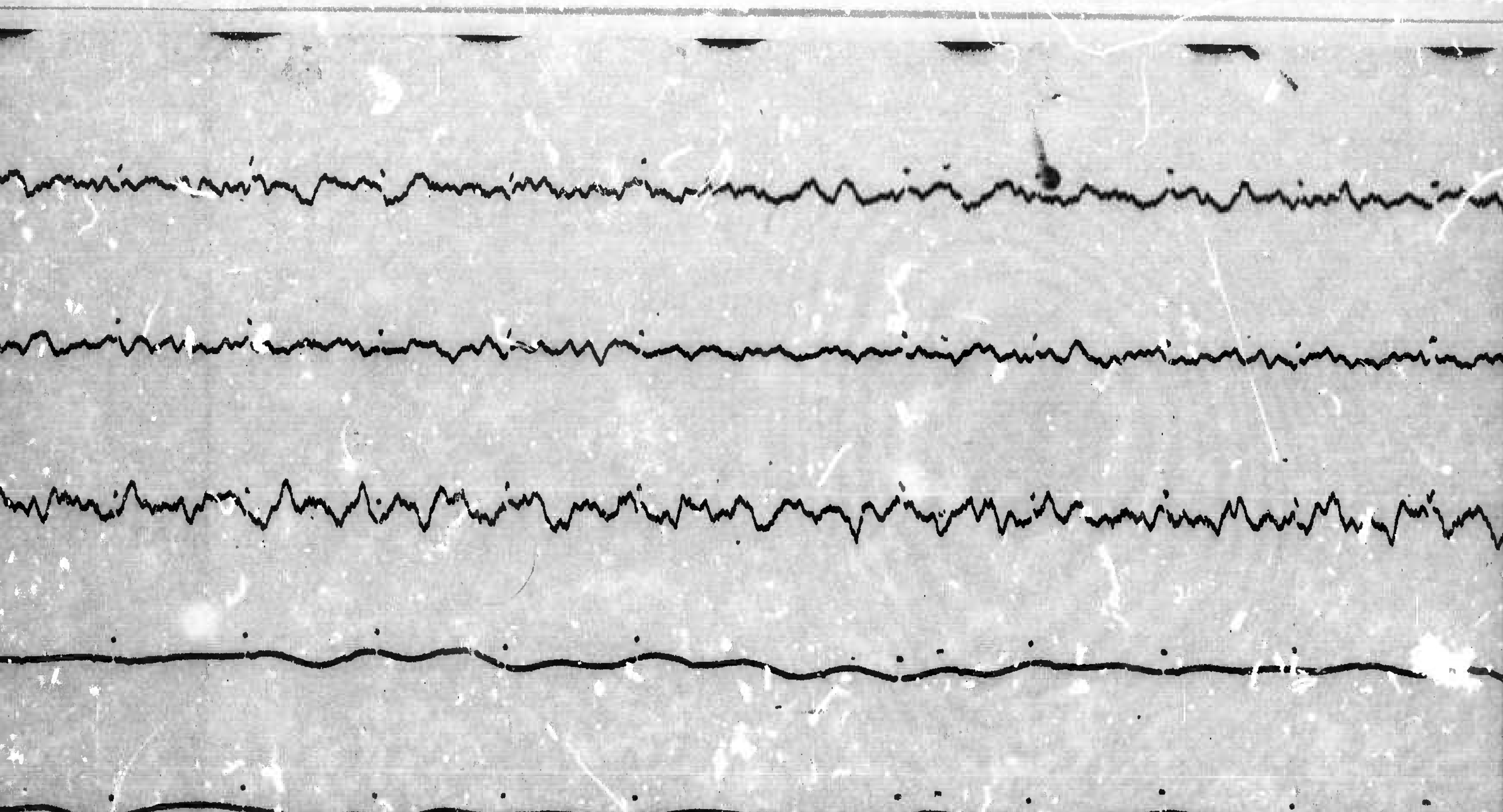

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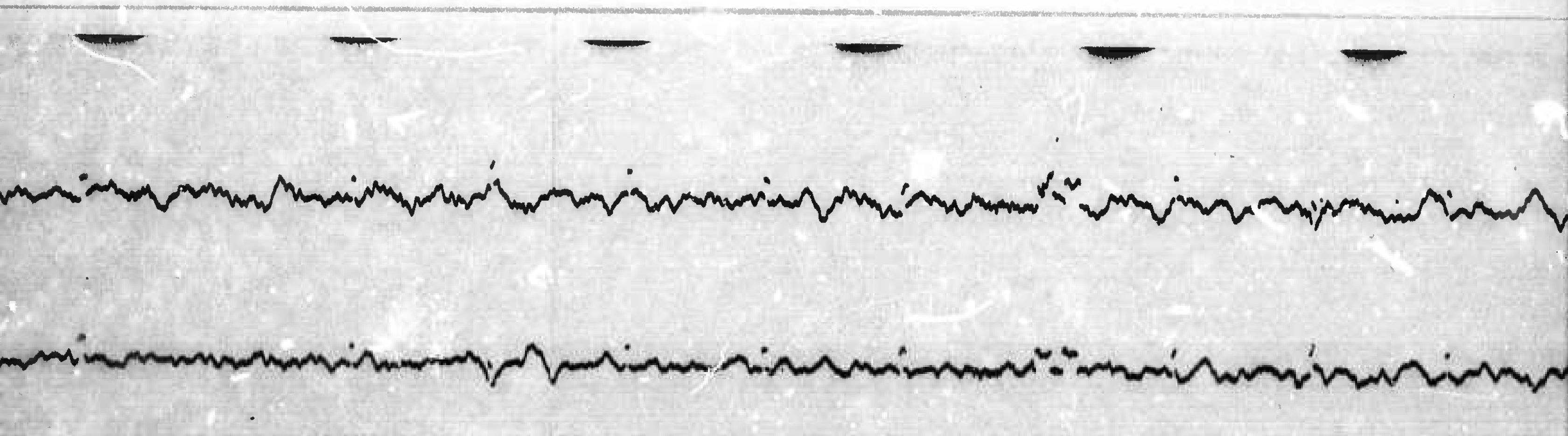

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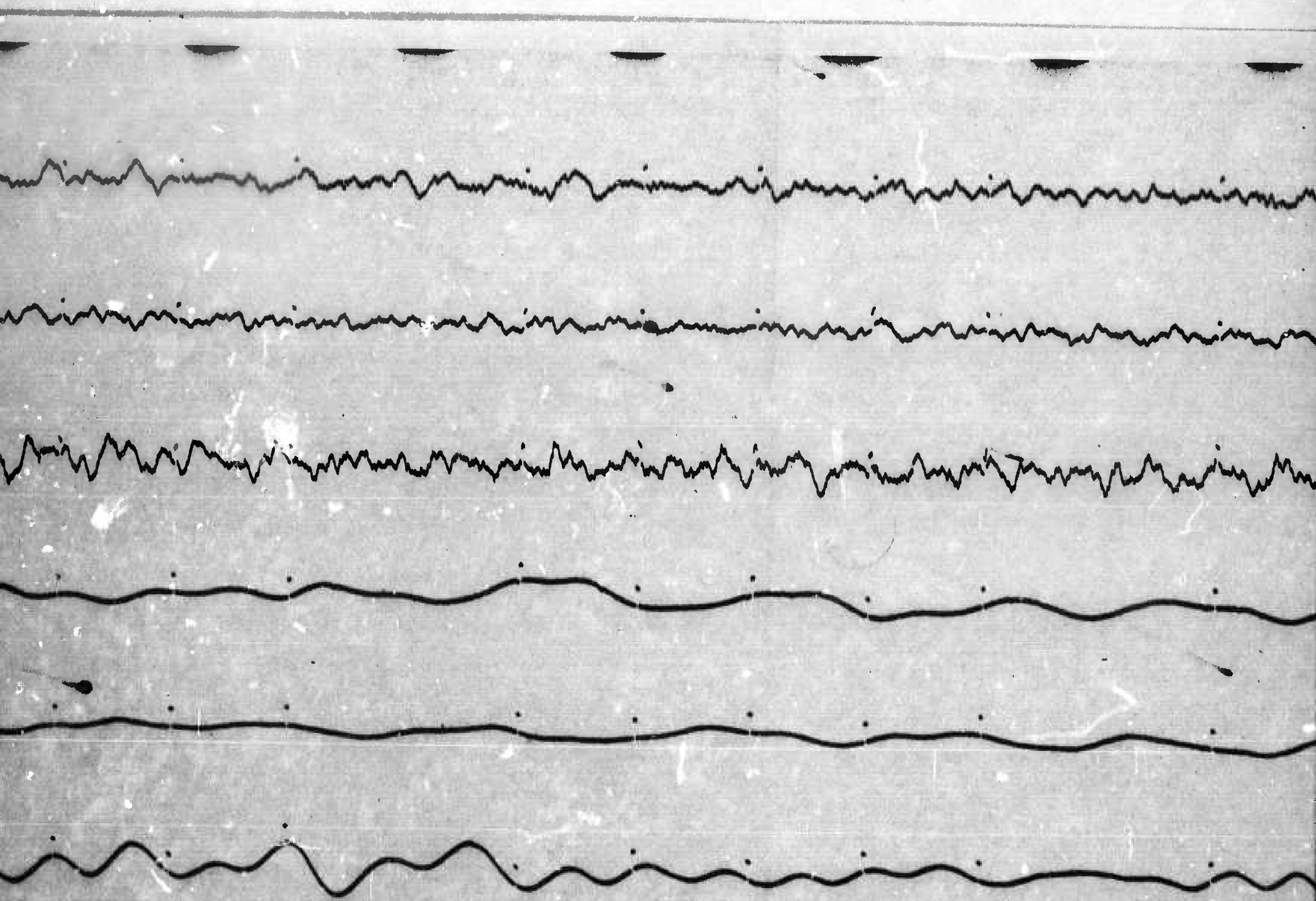

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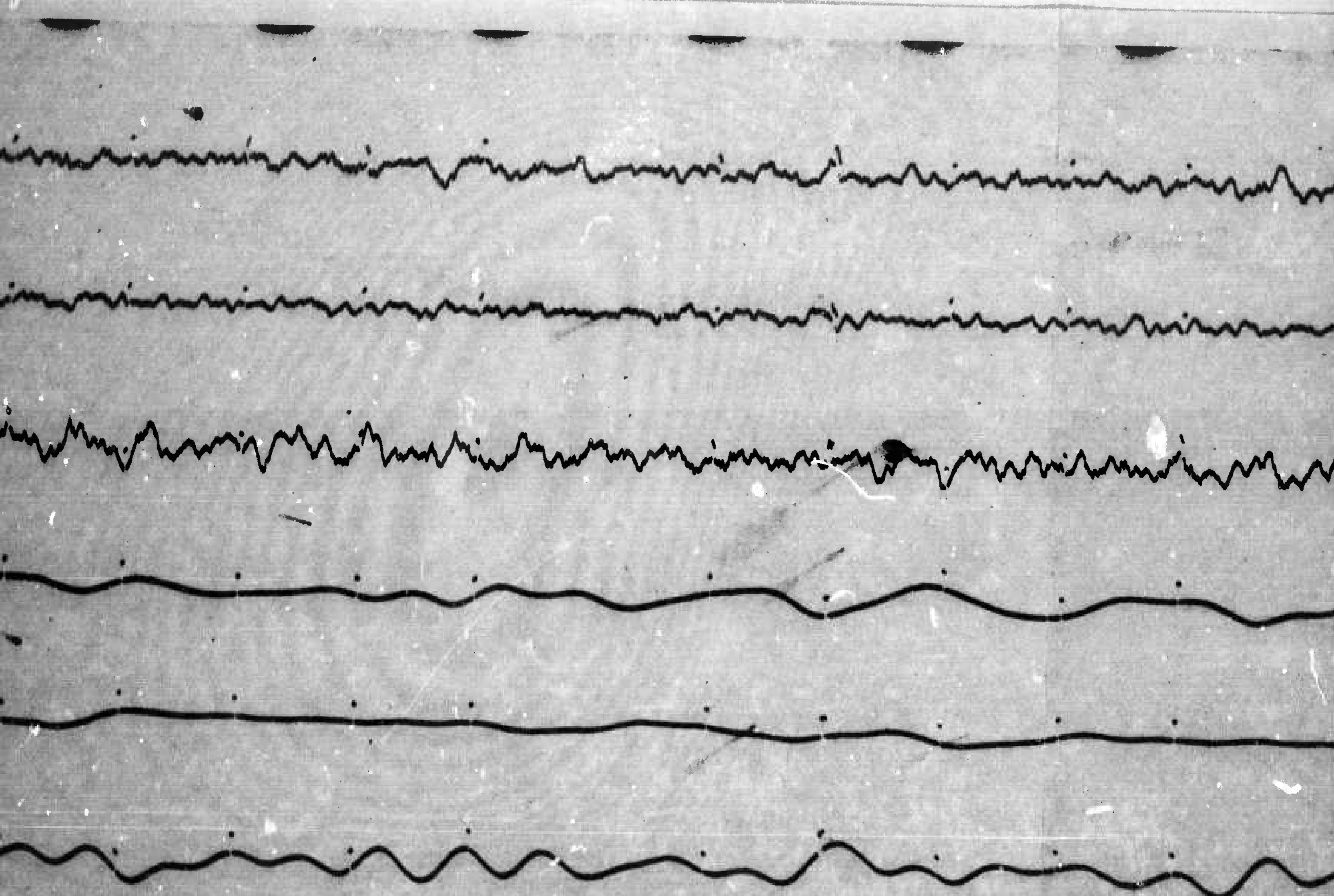

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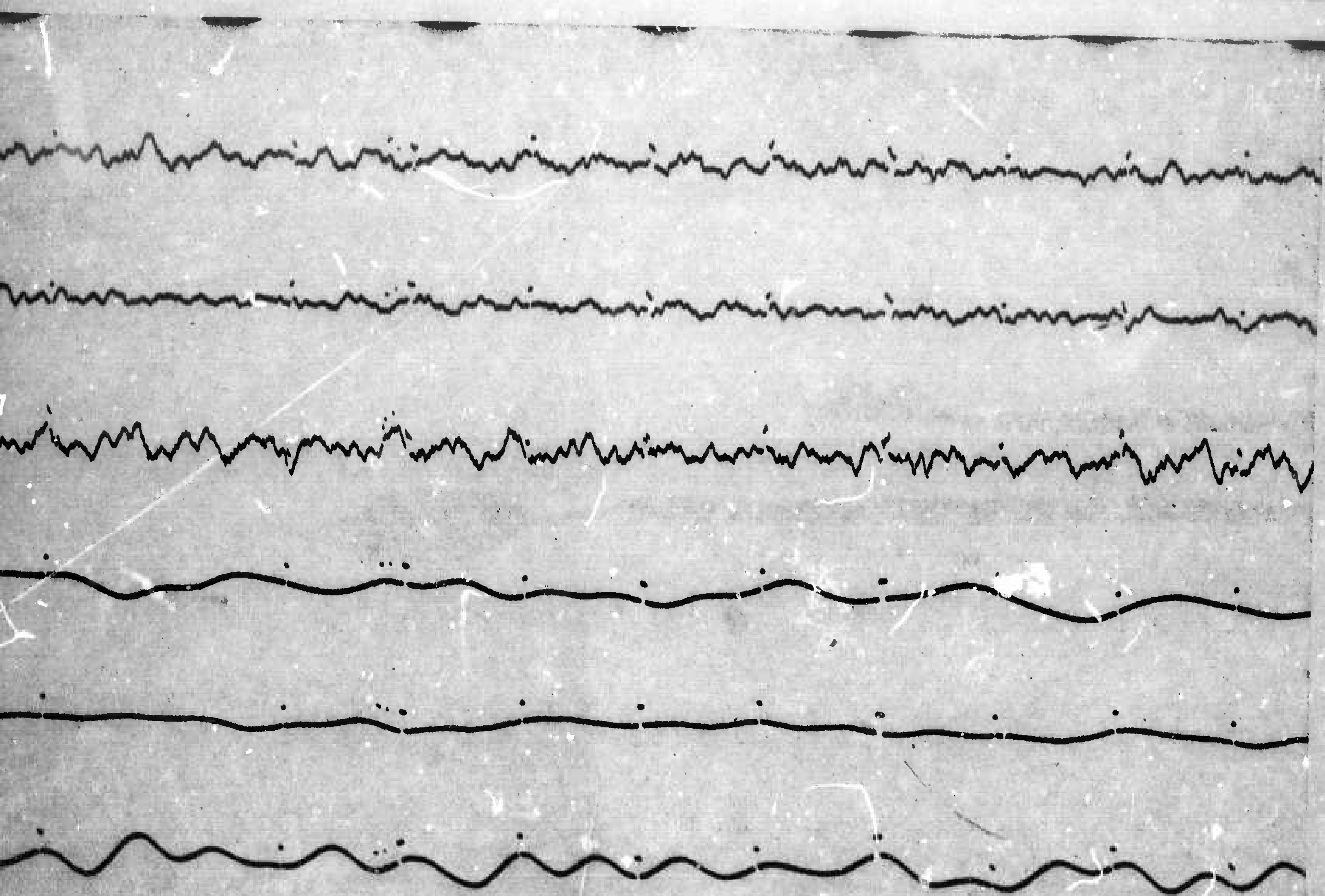

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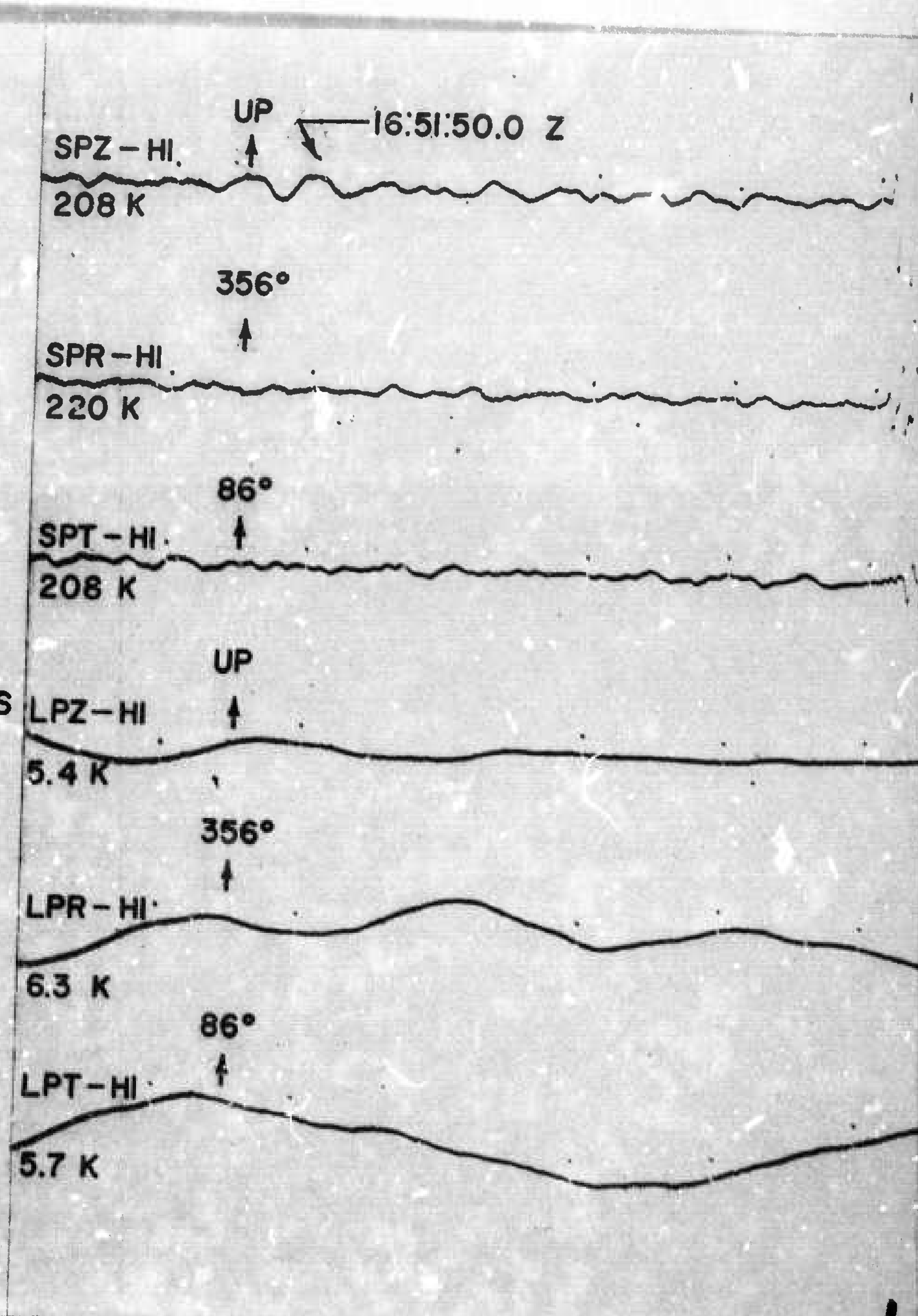
NASH

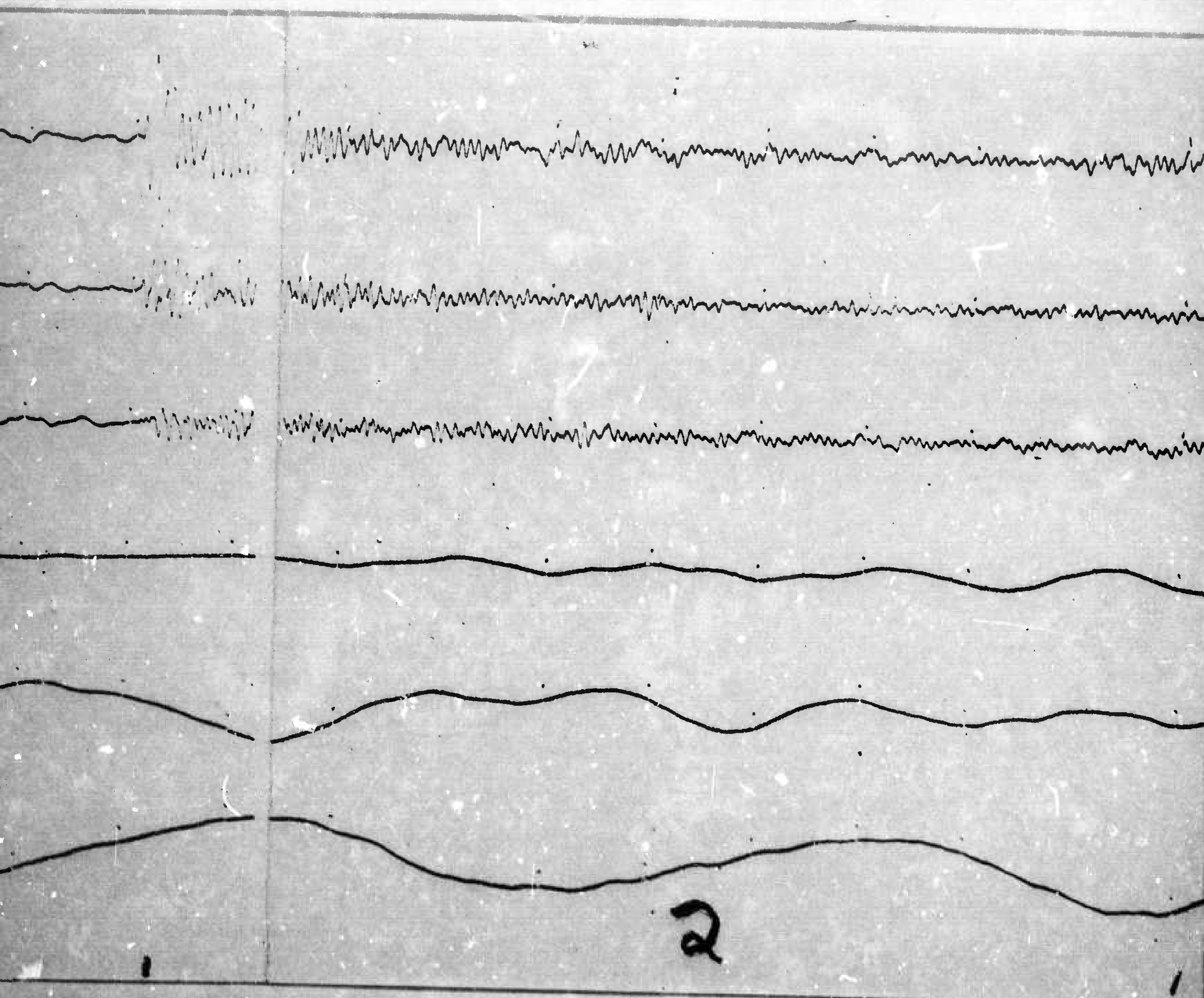
NP-NT

MOULD BAY, NORTHWEST TERRITORIES

19 JANUARY 1967

Δ = 4363km





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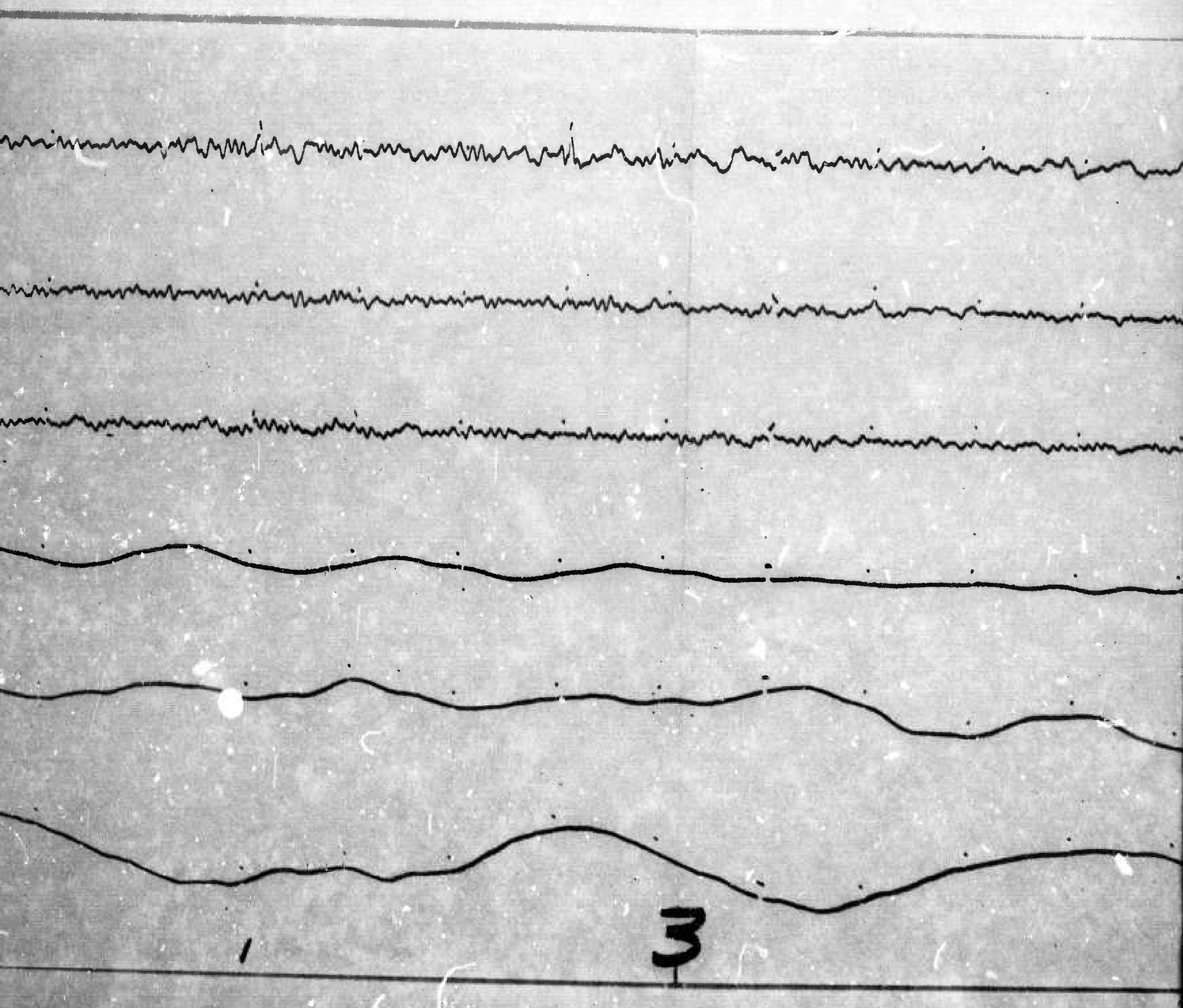
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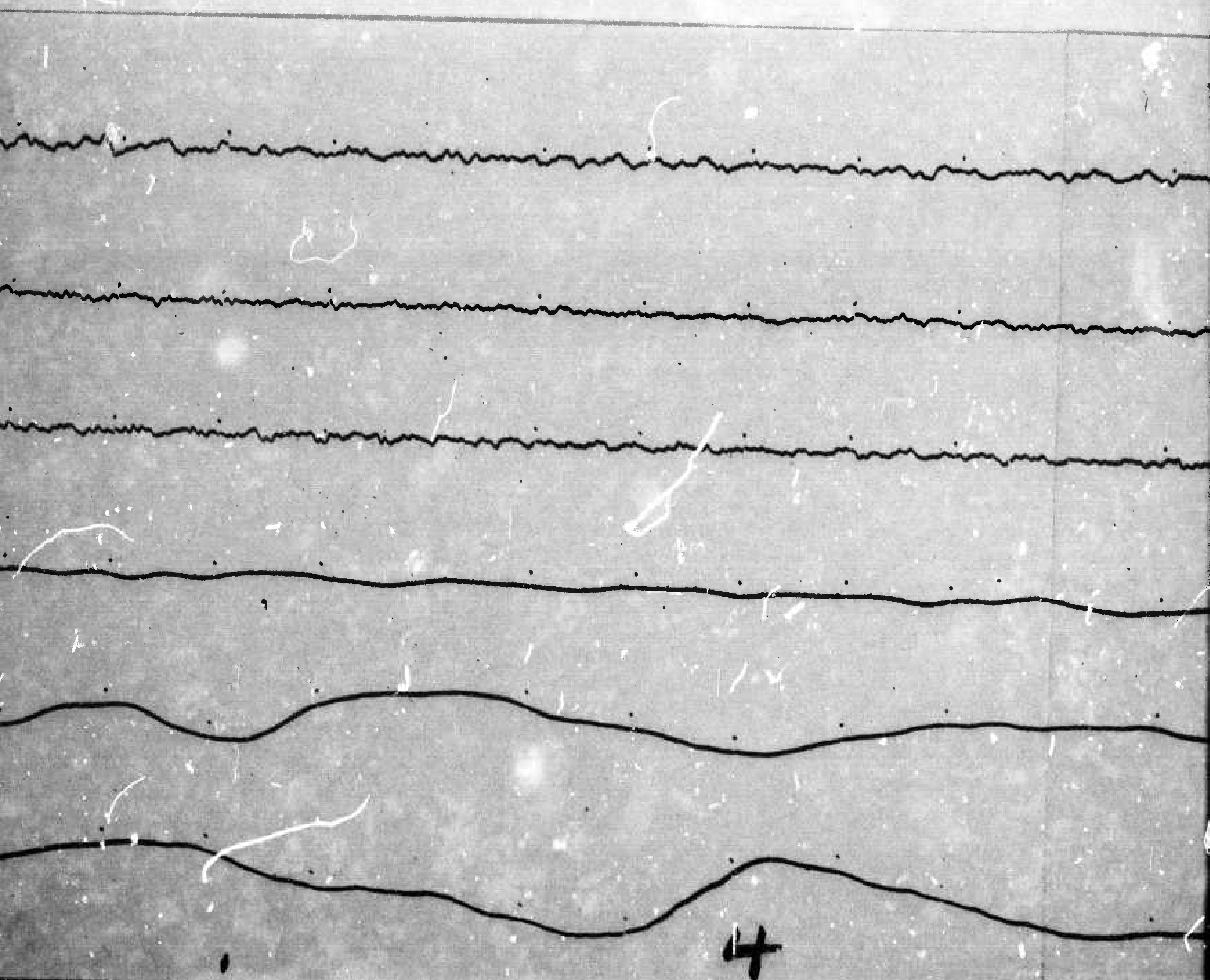
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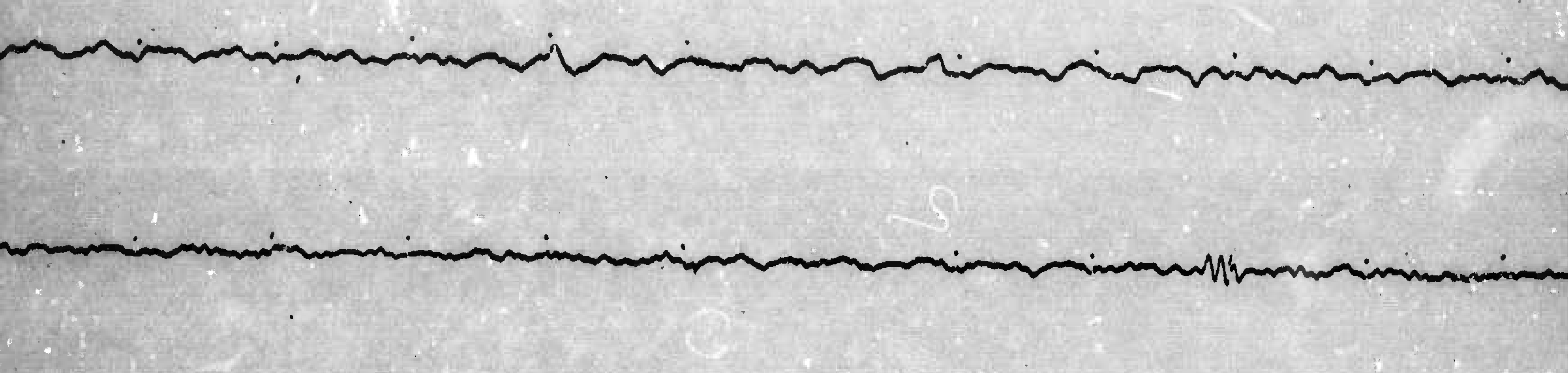

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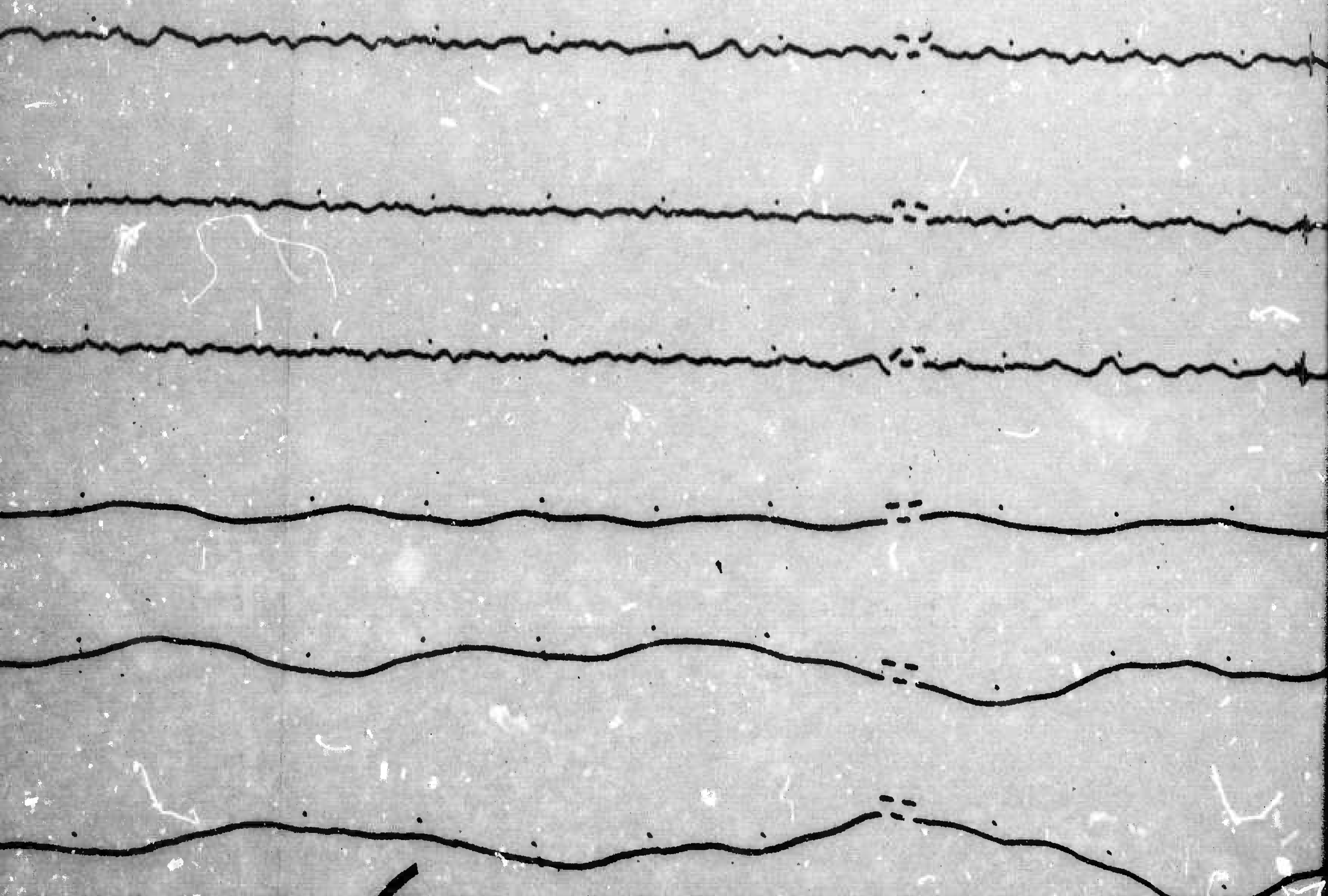

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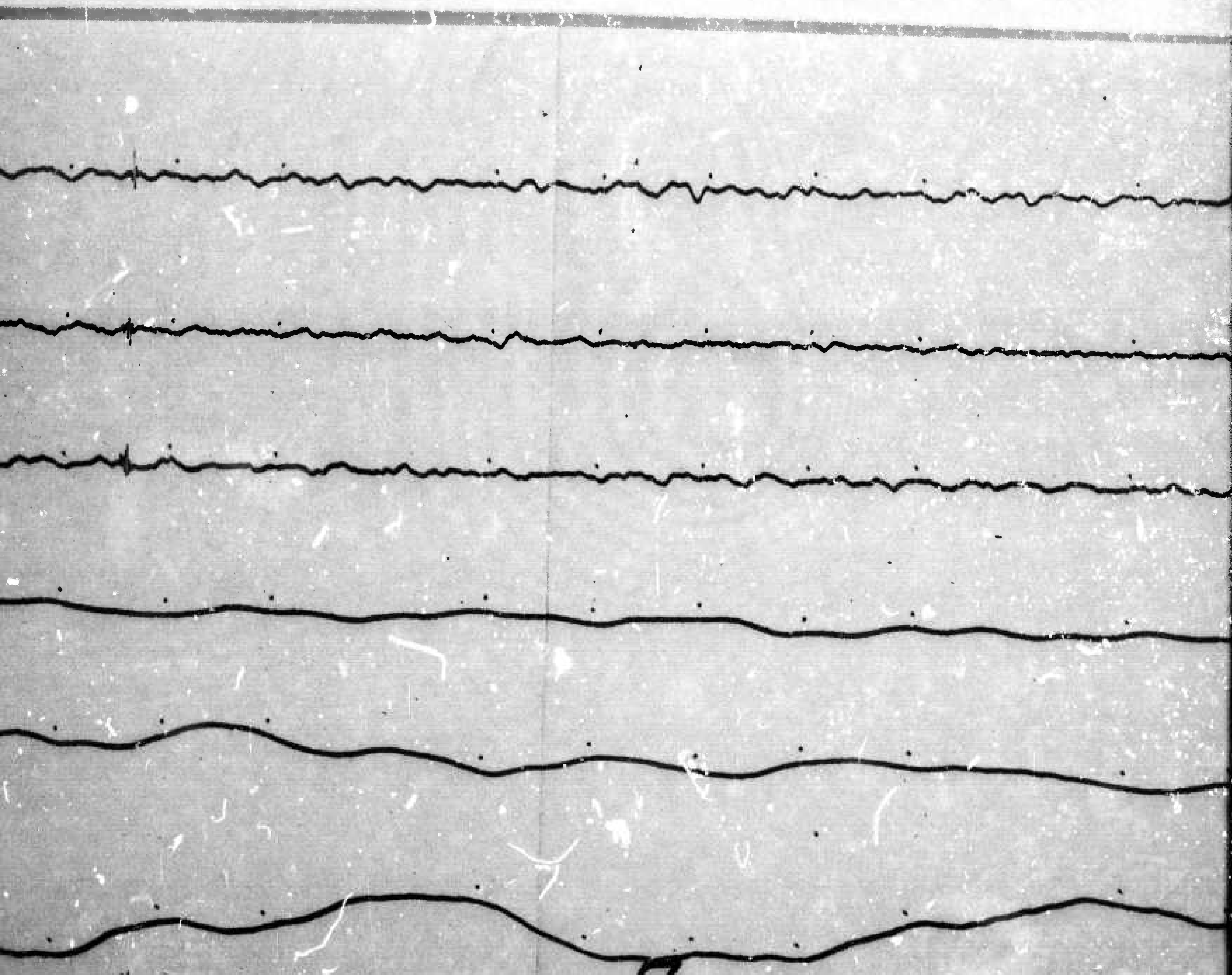
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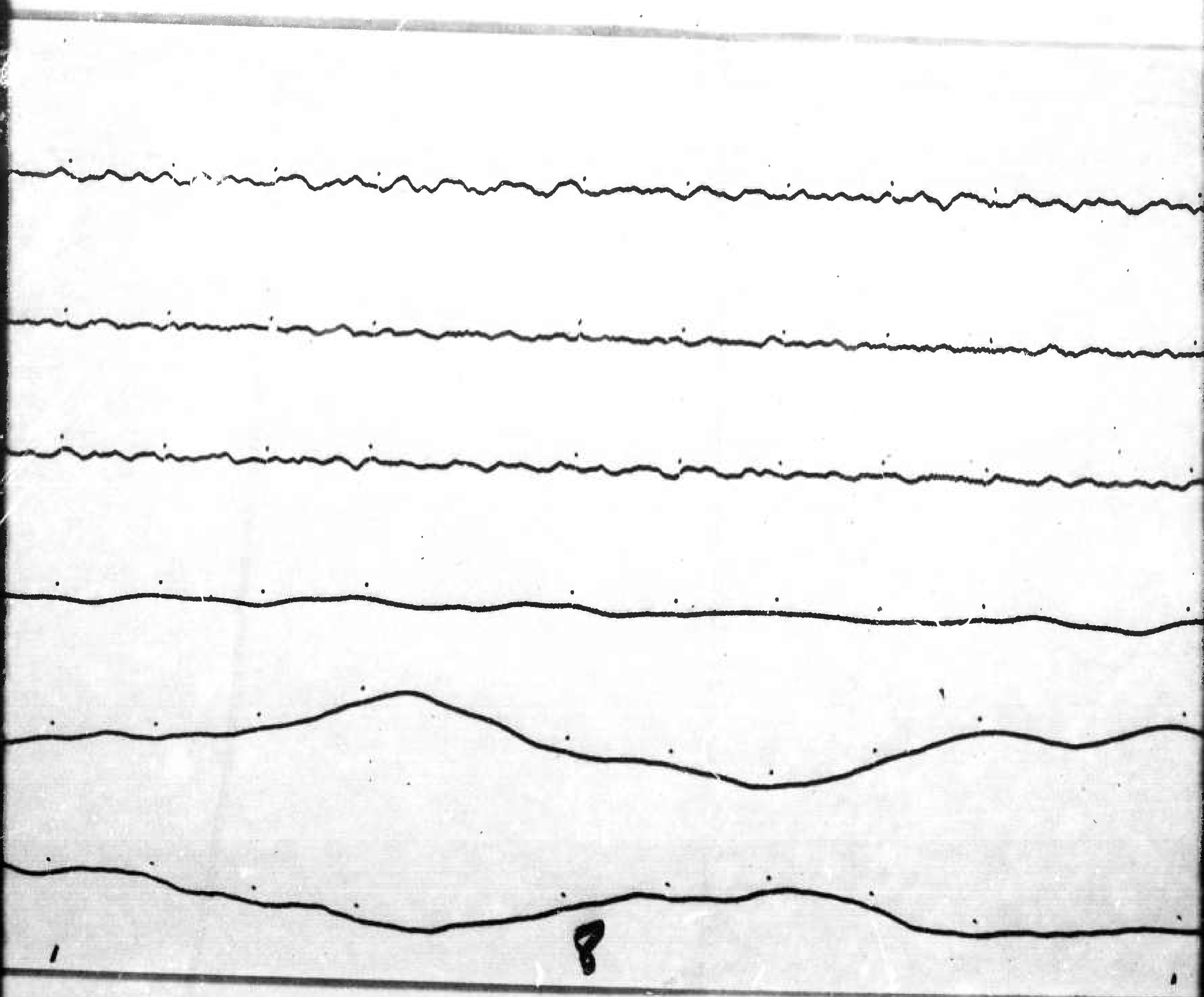
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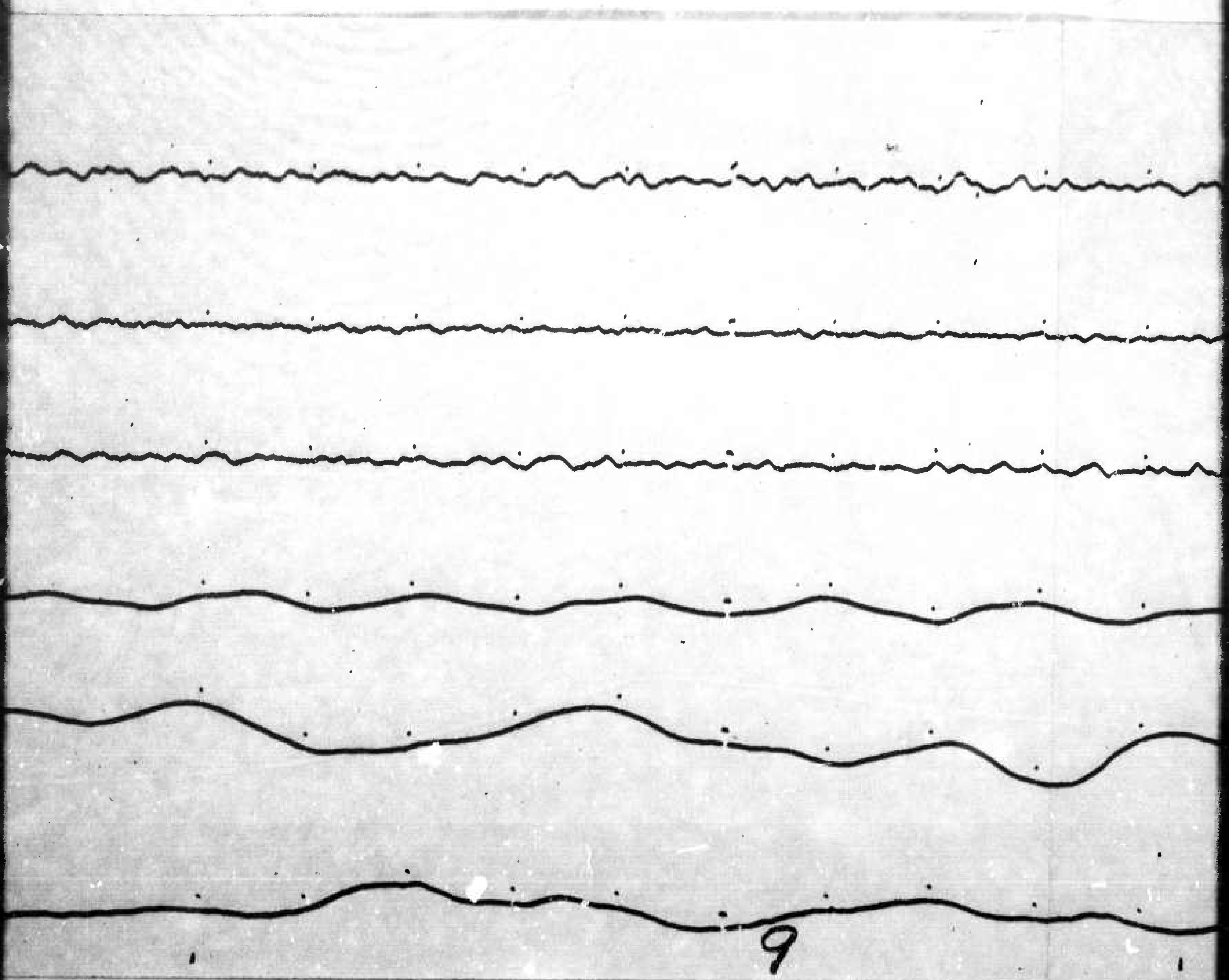
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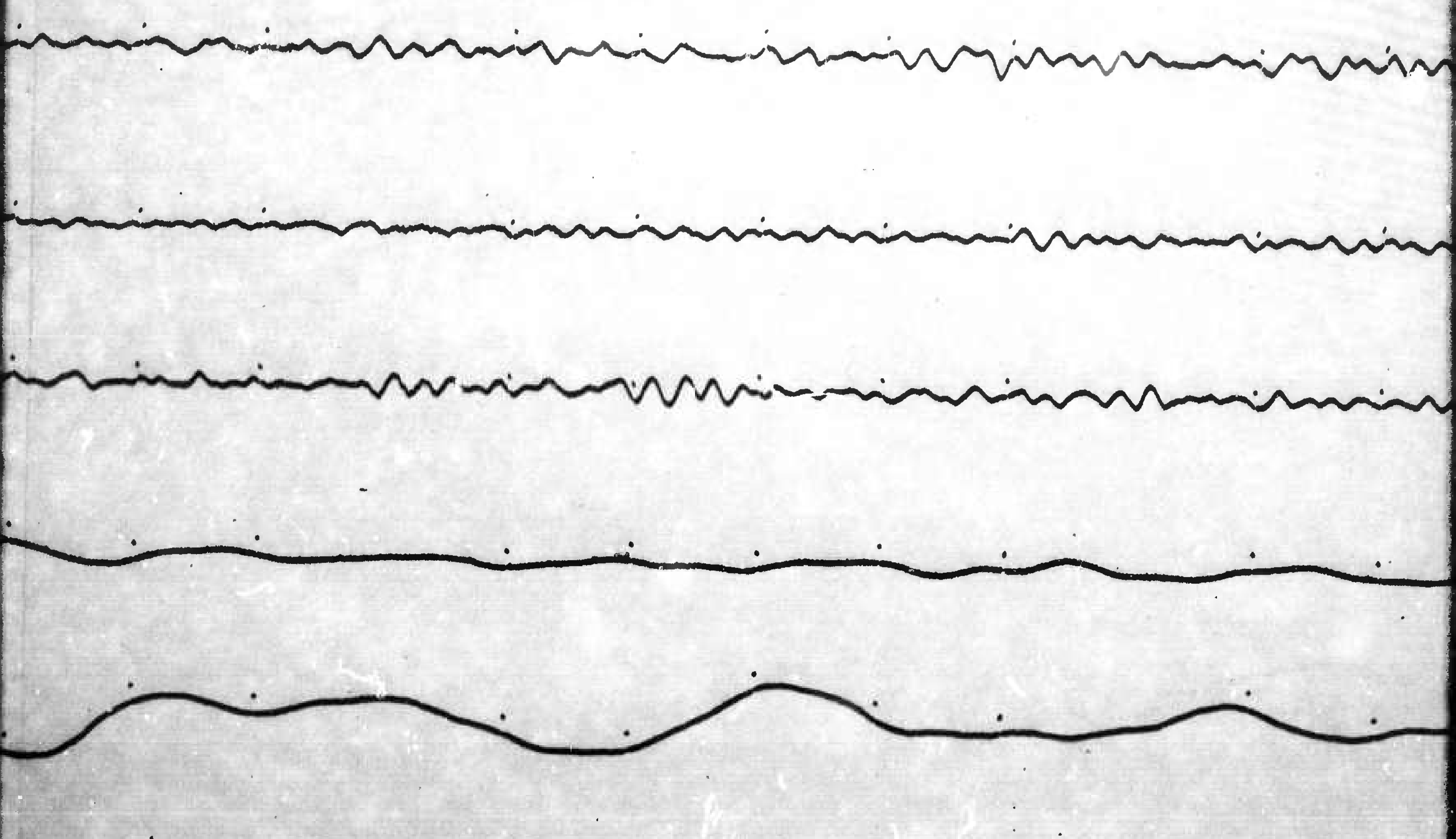

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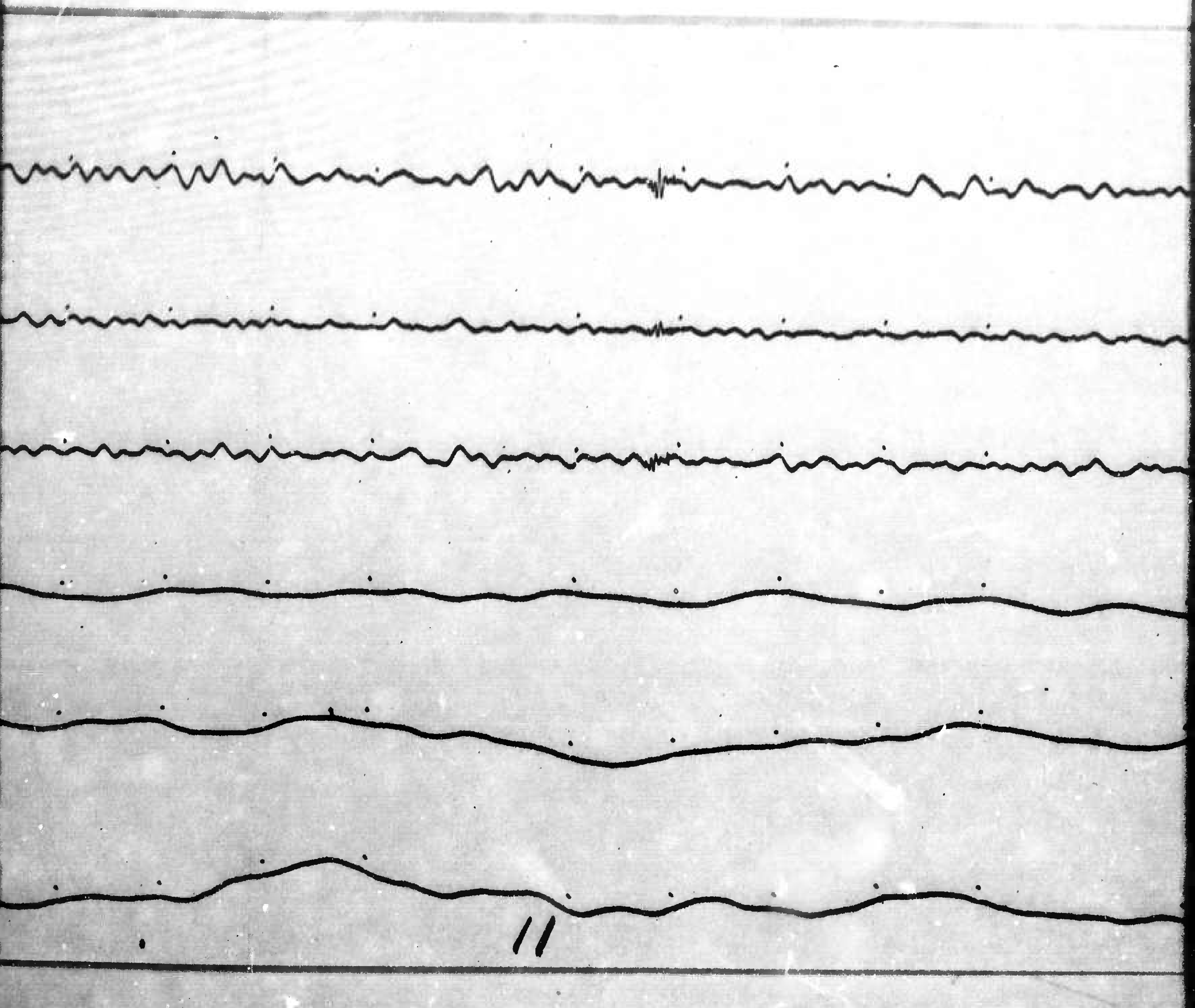
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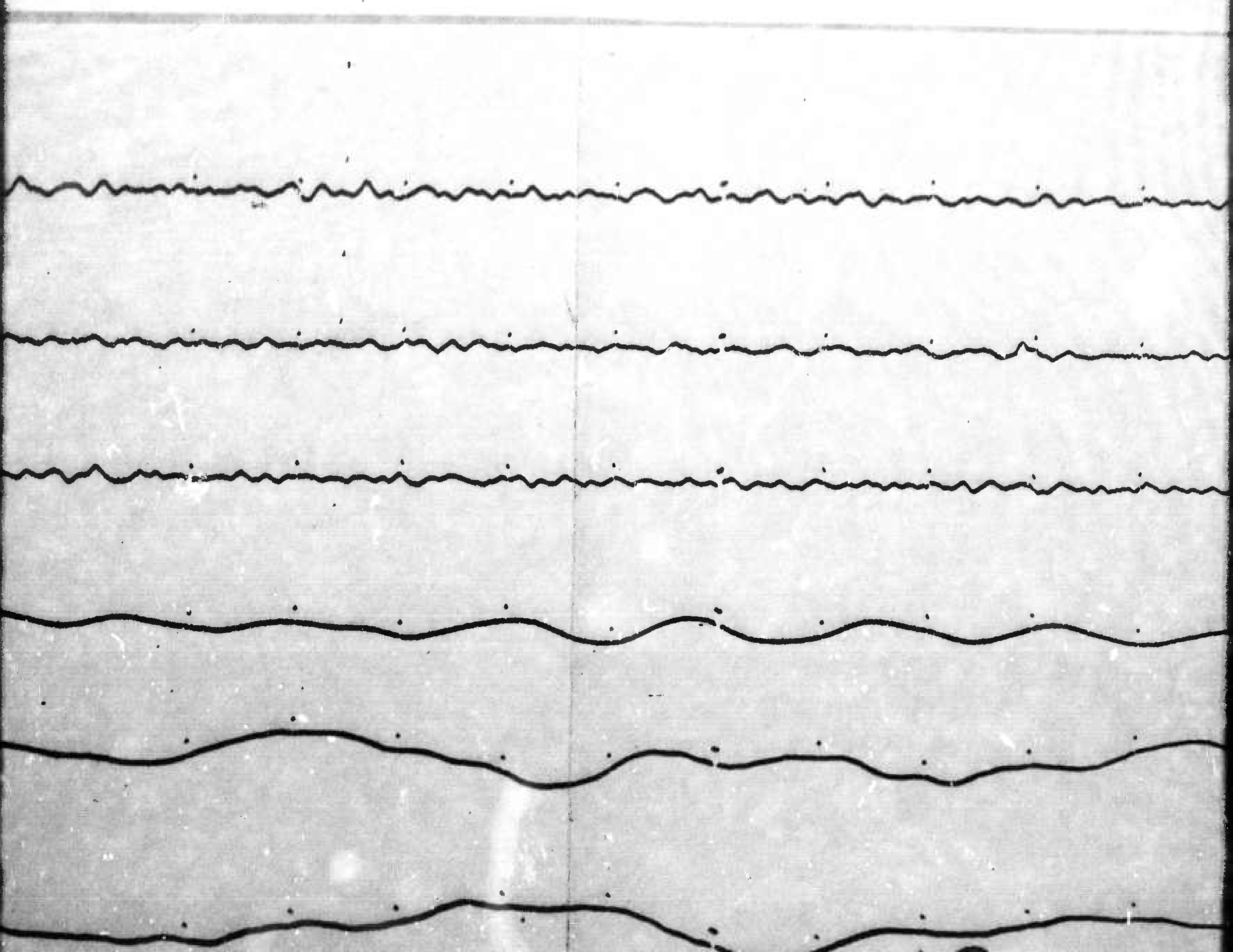
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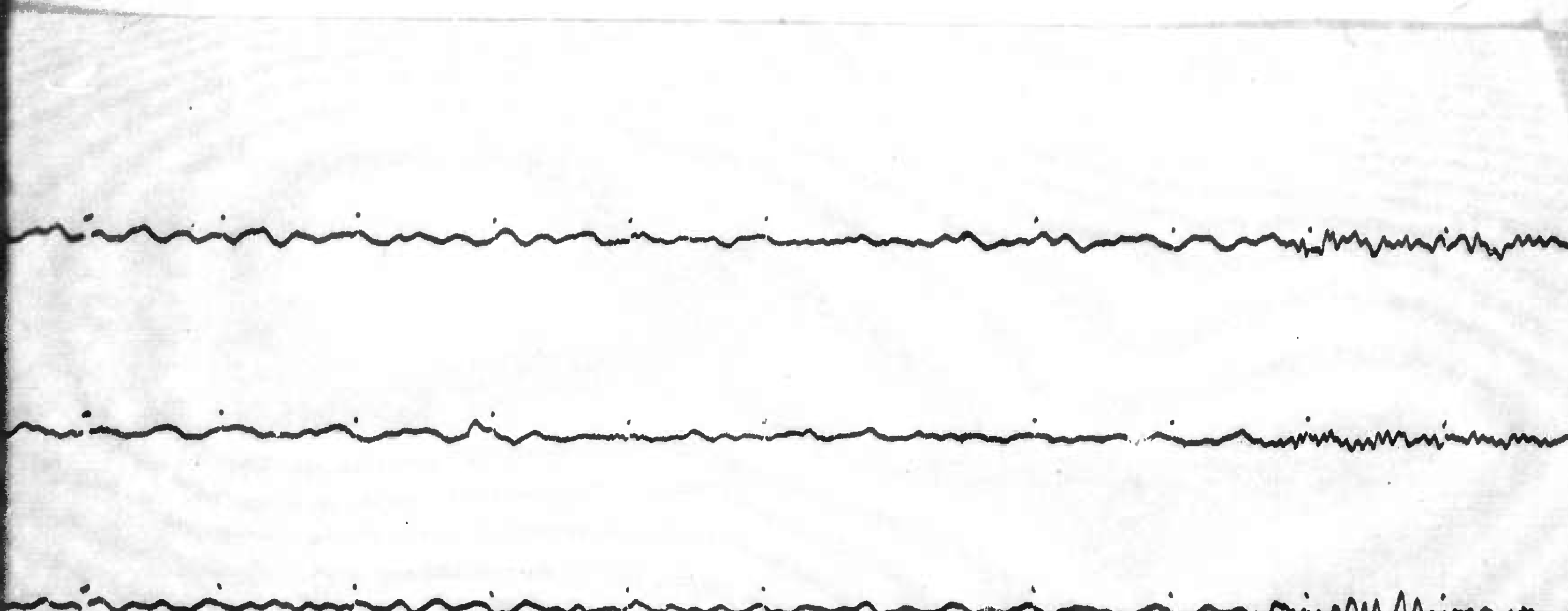
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